

# KELP FOREST MONITORING ANNUAL REPORT 1997



CHANNEL ISLANDS NATIONAL PARK



National Park Service  
Channel Islands National Park

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## **KELP FOREST MONITORING 1997 ANNUAL REPORT**

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## ABSTRACT

Observations and results of the 1997 Channel Islands National Park, Kelp Forest Monitoring Project are described. Population dynamics of 68 taxa, or categories, of algae, fish and invertebrates were measured at 16 permanent sites around the five islands within the Park. Survey techniques utilized SCUBA and surface-supplied-air, and included quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, video transects, size frequency measurements, artificial recruitment modules, and species list surveys. Temperature data was collected using remote temperature loggers. Size frequency measurements were taken from artificial recruitment modules at ten sites. In 1997, six sites had *Macrocystis pyrifera* (giant kelp) forests, one site was a open area with a moderate amount of red algae and some *M. pyrifera*, and nine sites were dominated by echinoderms. Of the nine sites dominated by echinoderms, one was dominated by *Pachythyone rubra* (aggregated red sea cucumbers), one by *Strongylocentrotus franciscanus* (red sea urchins), one by both *Strongylocentrotus purpuratus* (purple sea urchins) and *Ophiothrix spiculata* (brittle stars), one by both *S. purpuratus* and *S. franciscanus*, and five by *S. purpuratus*.

## EXECUTIVE SUMMARY

Channel Islands National Park has conducted long-term ecological monitoring of the kelp forests around Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel Islands since 1982. Permanent transects were established at 16 sites between 1981 and 1986. In 1997, the sites were monitored during seven five-day cruises between June and October. The 1997 kelp forest monitoring was completed at all 16 monitoring sites by 35 National Park Service (NPS) and volunteer divers completing a total of 781 dives. This annual report contains a summary of the methods used to conduct the monitoring in 1997 and a brief description of the sites along with the results. All of the data collected during 1997 can be found in the Appendices.

Divers using SCUBA or surface-supply-air completed all quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, size frequencies, artificial recruitment modules (ARMs) and video transects. Transect lead line repair was completed as necessary at all locations. Temperature loggers were retrieved and deployed at all sites. All proposed data collection was completed this year except for three fish transects and some temperature data. The fish transects could not be conducted due to unsafe diving conditions or inadequate water visibility, and temperature data loss was due to temperature logger failures.

In 1997, *Macrocystis pyrifera* (giant kelp) forests were present at six of the 16 Kelp Forest Monitoring sites. These sites included, Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, Yellowbanks at Santa Cruz Island, Cathedral Cove and Landing Cove at Anacapa Island. One site, Rodes Reef at Santa Rosa Island was an "open" area with a moderate amount of understory red algae and a few *M. pyrifera* plants. Nine sites were dominated by echinoderms. Gull Island South, Pelican Bay, and Scorpion Anchorage at Santa Cruz Island, Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus*. Hare Rock, San Miguel Island, was dominated by *Strongylocentrotus franciscanus*. Cat Canyon, Santa Barbara Island, was dominated by both *S. purpuratus* and *S. franciscanus*. Admiral's Reef, Anacapa Island, was dominated by both *S. purpuratus* and the brittle star, *Ophiothrix spiculata*, however some *M. pyrifera* was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*, and had a moderate density of *S. purpuratus*, *O. spiculata*, and *Astrangia lajollaensis*.

Eight sites had high *Strongylocentrotus purpuratus* densities this year compared to seven sites in 1996. Similar to last year, *S. purpuratus* dominated many areas on Santa Cruz, Anacapa, and Santa Barbara Islands that would probably be kelp forests if *S. purpuratus* densities were lower. Much of the subtidal habitat at Santa Barbara Island continued to be classified as sea urchin barrens with high densities of *S. purpuratus* and occasionally high densities of *S. franciscanus*. There were few canopy forming

*Macrocystis pyrifera* plants at Santa Barbara Island. The only notable patches of *M. pyrifera* were remnant kelp forests around Sutil Island, Cat Canyon, around the Webster point area, and some very small patches of kelp close to shore scattered around the island. At Anacapa Island, most of the south side and large portions of the north side of the middle and west parts of the island have high densities of *S. purpuratus* and little *M. pyrifera*. In contrast, most of the area inside the Anacapa Ecological Refuge on the North side of East Anacapa have healthy *M. pyrifera* forests with low densities of *S. purpuratus*. Four of the five sites at Santa Cruz Island have high densities of *S. purpuratus*.

Sea urchin wasting syndrome (Richards and Kushner, 1994) was observed at eight sites this year, similar to 1996. Near the end of the summer, wasting syndrome was beginning to cause mass mortality of *Strongylocentrotus purpuratus* and to a lesser extent *S. franciscanus* at Arch Point and Cat Canyon, Santa Barbara Island. Because quadrat counts were conducted earlier in the summer, any reduction of the sea urchin population will not be documented until the 1998 field season.

Sea star wasting disease (Schroeter and Dixon, 1988) was observed at 10 sites this year, compared to only two sites in 1996. This is the highest number of sites this disease has been observed since we began tracking it in 1992. Four species of sea stars were observed with wasting disease this year (Table 6) compared to two in 1996. We observed the stars, *Dermasterias imbricata* and *Mediaster aequalis* for the first time with sea star wasting disease.

The Island kelp fish, *Alloclinus holderi*, were recorded at their highest densities at nine of the ten sites where they are common. This was probably a result of the unusually warm waters brought about by this years El Niño.

## INTRODUCTION

The waters of Channel Islands National Park and Channel Islands National Marine Sanctuary contain one-third of southern California's kelp forests (Davies, 1968). Giant kelp, *Macrocystis pyrifera*, is the primary constituent of a southern California kelp forest, and over 1,000 species of macro flora and fauna live in this community (Woodhouse 1981, Engle pers. comm.). The kelp forest serves as food, shelter, substrate, and a nursery to resident as well as migratory species. Many species, while not residents of the kelp forest, are dependent upon the existence and productivity of kelp forests; detrital flux from kelp forests provides an important source of nutrients to nearby rocky shore, sandy beach, and estuary communities. The kelp forests are essential to California's commercial and sport fisheries as well as the recreation and tourist industries.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the islands. The Channel Islands National Marine Sanctuary overlaps the subtidal portions of the park, and its boundary extends six miles seaward from the Park Islands. Channel Islands National Park also bears the designation of International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the resources within the Park and manages them through the California Department of Fish and Game.

The federal law which established Channel Islands National Park (16-USC-410) mandated the development of inventories and monitoring of natural resources in the Park. Kelp Forest Monitoring is part of the long-term ecological monitoring program at the Park which is designed to measure the health of the ecosystems. By determining the limits of normal variation and diagnosing abnormal conditions we hope to prescribe remedial action through management recommendations.

Following a five year design study that began in 1982, the Kelp Forest Monitoring Program was implemented in 1987 by the Park's resource management division, using the protocol established during the design phase (Davis and Halvorson, 1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). Richards et al. (1997), describe monitoring efforts and results for 1982-1989. Richards et al. (1993a), Richards et al. (1993b), Richards and Kushner (1994), Kushner et al. (1995a), Kushner et al. (1995b), Kushner et al. (1997a), and Kushner et al. (1997b) describe the 1990, 1991, 1992, 1993, 1994, 1995 and 1996 monitoring efforts and results respectively. A review of the kelp forest Monitoring program was conducted in 1995 (Davis et al., 1996).

This report summarizes the monitoring efforts and results from 1997, our sixteenth year of monitoring. It is hoped that these reports will provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in this near-shore ecosystem. We have highlighted some



of the most important observations, and tried to provide a characterization for each site. Organisms are referred to by genus and species, except in the abstract and executive summary where both scientific and common names are used. Common names are cross referenced to their scientific names in Table 1. Since the design of the kelp forest monitoring project, several genera and species names have been changed. For the most part, the new and the old genus are listed together in this text. The new names are cross referenced in Table 1.

## METHODS

Abundance's and in some cases age structure of 68 taxa or categories of algae, fish, and invertebrates (Table 1) were measured at 16 permanent sites (Table 2) around the five Park islands (Figure 1). Site and species selection criteria, and sampling protocol are described in the Kelp Forest Monitoring Handbook (Davis et al., in prep.). Sites were monitored between June and September of 1997.

Each site is marked by a 100 m long transect affixed to the seabed. The sampling techniques employed to gather patterns of abundance and age structure are summarized in Table 3. At each station, 24 paired 1 m x 1 m quadrats that are systematically arranged along the transect with a random start, 40 continuous and adjacent 1 m x 5 m quadrats, and 24 paired 3 m x 10 m band transects that are systematically arranged along the transect with a random start, were used to determine densities and distribution of discrete benthic organisms; 600 random non-adjacent points (random point contacts - RPCs) are used to determine percent cover of encrusting invertebrates, algae and substrate composition; four 2 m x 3 m x 50 m fixed transects were used to determine fish abundance; roving diver fish count with a timed count and estimated abundance; video taped transects provide a record of the site appearance; and size frequency measurements were collected to determine age structure and recruitment cohorts. All animals measured for the natural size frequency distributions were located using a band transect type search method. A general species list was established for each site, noting presence/absence and relative abundance for all recognizable species. Artificial recruitment modules (ARMs) in place at ten of the sites to measure recruitment and population structure of indicator species within the ARMs. A complete description of the monitoring protocols can be found in Davis et. al, (in prep.).

STOWAWAY<sup>TM</sup> temperature loggers were deployed at all sites. Loggers were encased in underwater housings and attached to stainless steel thread rods cemented to the bottom at each site. HOBOTEMP<sup>TM</sup> temperature loggers were also deployed at each site as a backup in case of unit failure. The HOBOTEMP<sup>TM</sup> loggers were programmed to record temperature every 4.8 hours, and the STOWAWAY<sup>TM</sup> loggers programmed to record the mean temperature of 100 temperature readings per hour.

## STATION RESULTS

Sampling was completed at all 16 monitoring sites and a summary of the 1997 status of each site is presented in Table 4. Thirty five divers (Table 5) collected data on seven five-day cruises between June and September. A total of 781 dives with 585 hours of bottom time were completed.

A brief description of each site is included with the station results below. Complete data summaries from the sampling protocol are listed in the appendices. Means for 1-m<sup>2</sup> quadrats (Appendix A) represent average counts obtained from 24 paired 1 m x 1 m quadrats systematically arranged along the transect

with a random start. Means for 5m<sup>2</sup>-quadrats (Appendix B) represent average counts obtained from 40 continuous and adjacent 1m x 5m quadrats. Note that when adult, subadult and juvenile densities for *Macrocystis pyrifera* are listed in the station descriptions, the adult and subadult densities are derived from the 5m<sup>2</sup>-quadrats, and the juvenile densities from the quadrat data unless otherwise noted.

Means for band transects (Appendix C) represent average counts obtained from 24 paired 3 m X 10 m transects systematically arranged along the transect with a random start. Means for random point contacts (Appendix D) represent average percent cover for a given organism or substrate at 15 quadrats systematically arranged along the transect with a random start. Forty points from each quadrat (600 points total) are used to determine percent cover of selected organisms and substrate within one meter of the bottom. Percent cover may total more than 100% due to layering.

Means for fish transects (Appendix E) represent the average of four adjacent and continuous 2 m X 3 m X 50 m transects along the line. It should be noted that this is different from previous years when fish transects were 2m x 3m x 100m. Cases listed refer to the total number of passes over the transect made during sampling. All counts were conducted between 0900 and 1500 hours unless otherwise noted.

The Roving Diver Fish Count data are presented in Appendix F. The first page of this Appendix contains the number of observers that sampled and the total number of species observed for each sampling date and site. The following pages contain the average timed score and estimated abundance of each sampling date and site.

Natural habitat size frequency distributions for invertebrates other than gorgonians and *Stylaster (Allopora) californica* are in Appendix G. *Macrocystis pyrifera* size frequency distributions are in Appendix H. Gorgonian and *Stylaster (Allopora) californica* size frequency distributions are in Appendix I. Size frequency measurements taken from the Artificial Recruitment Modules were kept separate from the natural habitat measurements and their distributions are in Appendix J. Species lists for all locations are in Appendix K. Video transects were completed for all locations.

Temperature data were collected at all 16 sites using STOWAWAY<sup>TM</sup> and HOBOTEMP<sup>TM</sup> temperature loggers. One of each type of logger was deployed at each site, but only data from the STOWAWAY<sup>TM</sup> were used, unless the unit failed, then data from the HOBOTEMP<sup>TM</sup> were used. Sampling is conducted June - September, and we will present 12 months of temperature data from June 1, 1996 to May 31, 1997 (Appendix L). Temperature data was collected from all 16 sites except for the following due to temperature logger failures: data is missing from 7/20/96 - 8/7/96 for Johnson's Lee South at Santa Rosa Island, 6/19/96 - 10/2/96 for Scorpion's Anchorage at Santa Cruz Island, 6/6/96 - 8/21/96 for Yellow Banks

at Santa Cruz Island, 3/11/97 - 5/31/97 for Southeast Sea Lion at Santa Barbara Island, and 1/23/97 - 5/31/97 for Arch Point at Santa Barbara Island.

This year, as with previous years, sampling at the monitoring sites typically occurs over at least two separate dates, often several months apart. Separate sampling dates enables us to conduct fish transects at two different dates at least two weeks apart. During our first visit we attempt to conduct all of the abundance estimate techniques (quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, and roving diver fish count). During the second visit, fish transects and any remaining size frequencies are conducted. Occasionally abundance techniques are not completed during our first visit, and are subsequently finished during our second visit. If the time span between samplings appears to have impacted abundance estimates (due to changes in populations) this is noted in the results section below. Occasionally, a second sampling is conducted to document these changes.

**Location: Wyckoff Ledge, San Miguel Island**

1997 sampling dates: 7/8, 7/9, 9/24.

1997 status: Mature kelp forest with dense understory of red and brown algae.

Overall, this site appeared similar to previous years. On July 8<sup>th</sup>, *Macrocystis pyrifera* canopy cover was estimated at 100% and was notably thick. We estimated that 35% of the kelp blades looked healthy, while the remaining 65% were tattered with an abundance of epiphytic *Membranipora* sp. and a small amount of *Obelia* sp. Adult *M. pyrifera* density was similar to last year, but subadult plants were more abundant, though patchy. Juvenile *M. pyrifera* were less abundant than last year. Adult, subadult, and juvenile densities were 0.27/m<sup>2</sup>, 0.85/m<sup>2</sup>, and 0.29/m<sup>2</sup>, respectively. Coverage of *M. pyrifera* on the bottom was 37%. Understory brown and red algae were abundant and diverse. As usual for this site, brown algae were more abundant on the eastern 75 meters of the transect and red algae were more abundant on the western 25 meters. The most abundant brown algae was *Desmarestia* spp. This years coverage was 13%, lower than the previous two years. *Pterygophora californica* coverage was similar to last year at 5.3%, and both large and small adults were common. *Cystoseira* spp. coverage was similar to the last two years, 12%. Several adult and juvenile *Laminaria farlowii* were observed on quadrats. Their densities were 0.17/m<sup>2</sup> and 0.21/m<sup>2</sup> respectively. *Dictyoneuropsis reticulata*, similar in appearance to Laminaria, was common. *Gigartina* spp. (mostly *Gigartina corymbifera*) coverage was 9.2%. Miscellaneous red algae was abundant covering 66% of the bottom. Some of the most common species were *Rhodymenia* spp., *Botryoglossum* spp., and less common were *Plocamium* sp., *Porphyra* sp., as well as other unidentified species. Articulated and encrusting coralline algae covered 15% and 39% of the bottom respectively. Bare substrate covered 25% of the bottom.

During our second visit on September 24<sup>th</sup>, we observed a notable decrease in understory algae and the bottom appeared scoured, this may have been an artifact of the lack of understory algae. *Desmarestia* sp. covered 13% of the bottom on July 9<sup>th</sup>. However, during our second visit to the site on September 24<sup>th</sup> it was absent along the transect. On our second visit, red algae abundance was also notably less. While there was still an abundance of healthy *Macrocystis pyrifera*, there appeared to be less than on July 9<sup>th</sup>. On September 24<sup>th</sup>, there were an abundance of drift *M. pyrifera* stipes along the bottom that were bladeless. Overall, this decrease in algae and scoured bottom appeared to be a result of the large south swells that have affected this area over the past months.

The most common miscellaneous invertebrates on RPCs were hydroids and the worm, *Pista elongata*. This category covered 10% of the bottom. The hydroid, *Aglaophenia latirostris*, was common, but a variety of other species were also common. *Diopatra ornata* were common covering 8.5% of the bottom. *Phragmatopoma californica* was uncommon and none were observed during RPCs. Miscellaneous bryozoans were common covering 6.0% of the bottom. Tunicates and sponges covered 0.67% and 2.0% of the bottom respectively. *Tethya aurantia* were moderately abundant with a density of 0.12/m<sup>2</sup>. Gorgonians are uncommon at this site, and none were observed on band transects. *Urticina (Telia) lofotensis* were abundant on top and sides of large rocks. When band transects were conducted during our first visit to the site, one of the observers neglected to count *T. lofotensis*. We conducted band transects during our second visit for only *T. lofotensis* to acquire the counts. On September 24<sup>th</sup>, we observed a small unidentified cream/brown colored nudibranch on the *Macrocystis pyrifera* blades.

No kelp curler amphipods, *Amphithoe humeralis*, or giant caprellid amphipods were observed this summer, last year they were abundant. *Idotea resecata* were common, but were not as abundant as last year. Mysids were common in the kelp canopy, but were uncommon on the bottom during the July 8<sup>th</sup> visit. The red rock crab, *Cancer antennarius*, were common. Similar to last year, we observed many traps in this area, including one just off each end of the transect. We believe that these are fishing traps for rock crabs, *Cancer spp.*

*Kelletia kelletii* were counted on both quadrats and band transects and the densities were 0.21/m<sup>2</sup> and 0.16/m<sup>2</sup> respectively. Many of the *K. kelletii* were half buried in the sand making them difficult to observe. The *K. kelletii* are relatively small at this site compared to the other monitoring sites. *Lithopoma (Astraea) gibberosa* were common with a density of 0.25/m<sup>2</sup>, and small juveniles (<25mm) were observed. *Haliotis rufescens* density was similar to the past several years, 0.025/m<sup>2</sup>. We located 45 *H. rufescens* for size frequency measurements. Seven fresh *H. rufescens* shells were collected from around the transect. One *H. rufescens* was observed that appeared to have a slightly shrunken foot.

*Asterina (Patiria) miniata* were moderately abundant with a density of 1.9/m<sup>2</sup>. Leather stars, *Dermasterias imbricata*, were relatively abundant. *Pisaster giganteus* were common on the rocky outcrops along the transect, however they were uncommon directly along the transect where they are counted on quadrats. They were counted in both quadrats and 5-meter quadrats, and their densities were low at 0.33/m<sup>2</sup> and 0.04/m<sup>2</sup> respectively. Tiny (several mm) *P. giganteus* were observed on the *Macrocystis pyrifera* blades on September 24<sup>th</sup>. Both small and large *Pycnopodia helianthoides* were observed, and their density was 0.0083/m<sup>2</sup>. *Strongylocentrotus franciscanus* and *S. purpuratus* were common, but confined to crevices as is usual for this site. Their densities on quadrats were 0.29/m<sup>2</sup> and 0.25/m<sup>2</sup> respectively. *S. franciscanus* appeared to be more abundant in the large crevices this year, however this is difficult to monitor because few of the quadrats fall over this type of habitat directly along the transect. Two *Lytechinus anamesus* were observed on band transects. Sea star wasting disease was only observed on September 24<sup>th</sup> affecting several *Dermasterias imbricata*. No sea urchin wasting syndrome was observed.

Similar to what we observed last year, it appears that fish were not as abundant as years prior to 1996. Most notably are a decrease in the number of male *Semicossyphus pulcher* and *Sebastes miniatus* on the western end of the transect. Only one *S. miniatus* was observed on both visits (we believe this was the same fish) to this site this year. *Aulorhynchus flavidus* (Tubesnouts) were abundant and a large school was present during the roving diver fish count survey. Juvenile *Sebastes* spp. were moderately abundant in the kelp canopy during both visits to this site. However, they were notably larger on the second visit, September 24<sup>th</sup>. The roving diver fish count was conducted on July 8<sup>th</sup> with four divers observing 18 species of fish. One of the divers surfaced with a small fish attached to his wetsuit. We identified the fish as a spotted snailfish, *Liparis callyodon*, but are not positive of this identification.

It took three dives to complete band transects because of the thick understory of algae and thick canopy cover that created low light situations. Divers used underwater lights to aid in their search for indicator species.

### **Location: Hare Rock, San Miguel Island**

1997 sampling dates: 7/9, 9/24.

1997 status: *Strongylocentrotus franciscanus* Barrens.

This site was similar to previous years, and continues to be dominated by *Strongylocentrotus franciscanus*. Macroalgae was more abundant on top of rocks than in recent years. Most of this algae consisted of *Desmarestia* sp., *Laurencia pacifica*, and some foliose red algae. *Desmarestia* sp. covered 1.3% of the bottom. One subadult and one juvenile *M. pyrifera* were observed on the top of a large rock. Two juvenile *Eisenia arborea* were observed. Small patches of *Ulva* sp. were also observed.

Miscellaneous red algae (mostly filamentous) and filamentous diatoms were also more abundant than the past several years. Miscellaneous red algae and miscellaneous plants covered 7.0% and 13% of the bottom respectively. Diatom tufts were common growing in the patches of *Corynactis californica*. It appears that the *C. californica* may act as a barrier to the *Strongylocentrotus* spp., protecting the diatoms. Articulated coralline algae was uncommon with none being observed during RPCs. Encrusting coralline algae covered 68% of the bottom. Bare substrate was recorded at 18% coverage.

Similar to past years the most common miscellaneous invertebrates on RPCs were terebellid worms, and the worm, *Dodecaceria fewkesi*. This category covered only 8% of the bottom. It appears that the number of terebellid worms has decreased in the cobble areas where they are most common. *Corynactis californica*, was moderately abundant with a coverage of 8.3%. *Balanophyllia elegans* coverage was low, 0.17% when compared to previous years. *Astrangia lajollaensis* coverage was 1.5%, similar to previous years.

*Strongylocentrotus franciscanus* were abundant and dominated the site with a density of 13/m<sup>2</sup>. The *S. franciscanus* were observed to have notably long and brittle spines that were easily broken off, this is typical for this site. *S. purpuratus* were common, but very patchily distributed. Their density was 0.042/m<sup>2</sup> along the transect. Juvenile *S. franciscanus* and *S. purpuratus* were less abundant than previous years. All of the *Strongylocentrotus* spp. were out in the open and not confined to crevices, typical for this site. *Asterina (Patiria) miniata* were abundant with a density of 3.3/m<sup>2</sup>. *Pisaster giganteus* were also abundant and counted on both quadrats and 5-meter quadrats. Their densities were 0.25/m<sup>2</sup> and 0.37/m<sup>2</sup> respectively. Small and large *Pycnopodia helianthoides* were moderately abundant along the transect with a density of 0.050/m<sup>2</sup>. *P. helianthoides* were observed feeding on *Aplysia californica* and *S. franciscanus*. *Parastichopus parvimensis* were notably large, but uncommon. None were observed during quadrats. During our brief visit on September 24 we observed several *Asterina (Patiria) miniata* and *Pisaster giganteus* with wasting disease.

On July 9<sup>th</sup>, mysids were extremely abundant on the bottom. Both small and large mysids were present, and their sheer numbers combined with green water, greatly reduced visibility at this site. Some barnacles were present on the temperature housing this year, but there was not as many and they were smaller than last year. *Balanus* sp. were common on the western side of the transect, and several *Pisaster giganteus* were observed feeding on them. Both *Cancer antenarius* and *C. productus* were observed. *Pandalus danae* were common as usual for this site.

Fresh small *H. rufescens* shells were common indicating recent recruitment. We did not have enough time to turn over small rocks to search for live juveniles. *Kelletia kelletii* were uncommon with a density of

0.0028/m<sup>2</sup>. *Aplysia californica* were also uncommon with a density of 0.0028/m<sup>2</sup>. *Cypraea spadicea* were common as usual for this site with a density of 0.63/m<sup>2</sup>.

Adult *Sebastes mystinus*, *S. serranoides*, and *S. atrovirens* were the most common fish at this site. Juvenile *Sebastes* spp. were common and several juvenile *S. serranoides* were observed. *Embiotoca jacksoni* and *Chromis punctipinnis* were common. A small group of *Damalichthys vacca* were observed. *Oxylebius pictus* were common. One lingcod, *Ophiodon elongatus* was observed and at least four Cabezon, *Scorpaenichthys marmoratus* were observed. Several female and one small male *Semicossyphus pulcher* were observed. *Coryphopterus nicholsii* were common with a density of 0.33/m<sup>2</sup>. Roving diver fish count was conducted on July 9<sup>th</sup> with seven divers observing 21 species.

The Stowaway temperature logger #2902 turned off probably from battery failure on June 4, 1997. However, the Hobotemp backup temperature logger #2409 was working, so complete temperature data was acquired at this site.

On September 24<sup>th</sup> we attempted to conduct fish transects, some size frequencies and species list survey, but had to abort the dive due to the large northwest swell.

### **Location: Johnson's Lee North, Santa Rosa Island**

1997 sampling dates: 7/8, 7/10, 9/25.

1997 status: Mature Kelp forest.

Overall, this site was similar to previous years, however there was more *Macrocystis pyrifera* than last year. *M. pyrifera* canopy cover was estimated at 80% over the transect on July 8th. *M. pyrifera* adult, subadult, and juvenile densities were 0.68/m<sup>2</sup>, 0.33/m<sup>2</sup>, and 0.71/m<sup>2</sup> respectively and covered 40% of the bottom. It was often difficult to swim near the bottom due to the high density of *M. pyrifera*. The *M. pyrifera* appeared healthier than at the deeper Johnson's Lee South site. Most of the blades were clean or had few epiphytes growing on them. There was a moderate amount of understory brown algae. Adult and juvenile *Laminaria farlowii* were common with densities of 0.17/m<sup>2</sup> and 0.17/m<sup>2</sup> respectively, and covered 2.3% of the bottom. Adult and juvenile *Pterygophora californica* were also common with densities of 0.46/m<sup>2</sup> and 0.13/m<sup>2</sup> respectively and covered 6.8% of the bottom. *Cystoseira* spp. covered 17% of the bottom and was more abundant here than at the deeper Johnson's Lee South site. Miscellaneous red algae coverage was 49%, similar to last year. *Gigartina* spp. was less abundant this year, covering 1.7% of the bottom. Articulated and encrusting coralline algae covered 9.3% and 9.8% of the bottom. During our first visit in July, the bottom did not appear as scoured as we observed last year, and bare substrate decreased to 25% coverage. However, on our second visit on September 25, the site appeared scoured



similar to Wyckoff Ledge. On this second visit we felt there was no notable increase or decrease in algae or invertebrate abundance on the bottom. *Macrocystis pyrifera* canopy cover had decreased since our earlier visit. It was estimated at only 30%, and most of the *M. pyrifera* plants just reached the surface creating little canopy.

Similar to last year, the most common miscellaneous invertebrates on RPCs were hydroids. This category covered 14% of the bottom. Tunicates and sponges were more abundant than last year and diverse. Their coverage's were 7.3% and 2.8% respectively. *Phragmatopoma californica* was common in *Macrocystis pyrifera* holdfasts, and was more common than last year with a coverage of 6.3%. Bryozoans were more abundant than last year and were diverse. Combined they covered 31% of the bottom, and *Bugula neritina* was the most abundant. *Diaperoecia californica* was more abundant than last year, and large colonies were common along ledges. Large and small *Tethya aurantia* were common with a density of 0.10/m<sup>2</sup>. The proliferating anemone, *Epiactis prolifera* were common growing on the *M. pyrifera* blades. *Astrangia lajollaensis* were common covering 2.7% of the bottom. *Styela montereyensis* were common with a density of 0.88/m<sup>2</sup>.

*Strongylocentrotus franciscanus* were common in crevices, and their density along the transect was 0.42/m<sup>2</sup>. *S. purpuratus* were relatively uncommon along the transect with a density of 0.29/m<sup>2</sup>. Only 100 *S. franciscanus* and 34 *S. purpuratus* were measured for size frequencies. Many other *Strongylocentrotus* spp. were located, but were too deep in crevices to accurately measure without causing harm to the animals.

*Asterina (Patiria) miniata* were common with a density of 0.83/m<sup>2</sup>. Leather stars, *Dermasterias imbricata*, were also common. Overall, *Pisaster giganteus* were common, but were abundant in patches along the areas of high relief. They were counted on both quadrats and 5-meter quadrats with densities of 0.25/m<sup>2</sup> and 0.27/m<sup>2</sup> respectively. *Pycnopodia helianthoides* were common with a density of 0.039/m<sup>2</sup>. *Parastichopus parvimensis* density was 0.33/m<sup>2</sup>. Small *Henricia leviuscula* were moderately abundant. No sea star wasting disease was observed at this site.

*Cypraea spadicea* were common with a density of 0.66/m<sup>2</sup>. Several very large *Lithopoma (Astraea) undosum* were observed, but were rare and none were observed on quadrats. *Kelletia kelletii* were uncommon as usual for this site, only three were observed on band transects (0.0042/m<sup>2</sup>). *Megathura crenulata* were common on the rocky outcrops with a density of 0.0069/m<sup>2</sup>. Only one *Haliotis rufescens* was observed during band transects (0.0014/m<sup>2</sup>). We searched the entire transect for *H. rufescens* for size frequency measurements, and only 10 were found, all were under ledges or in deep crevices. No abalone were found in the area about one meter east of the 73 m mark that was mentioned in previous

reports. Abalone shells were collected, measured and disposed of off the transect; several large fresh shells were found. Several octopus, *Octopus bimaculoides* were observed.

A large school of adult *Girella nigricans* were observed swimming in the kelp canopy over the transect. Small schools of *Oxyjulis californica* and top smelt, *Atherinops affinis*, were common in the kelp canopy and midwater. Juvenile *Sebastes spp.* were abundant in the kelp canopy and school of about 50 young-of-year *Sebastes serranoides* was observed near the bottom. Adult and juvenile *Embiotoca jacksoni* and *E. lateralis* were common. Several *Semicossyphus pulcher* were observed. The resident *Hypsypops rubicundus* at 73 m along the transect was present as usual with a nest, and this year there were eggs present. One kelp gurnel, *Ulvicola sanctaerosae* was observed. No fish were observed on quadrats this year. Roving diver fish counts was conducted once on July 8<sup>th</sup> with eight divers observing 22 species.

All 13 ARMs were monitored for all indicator species. All of the ARMs were intact and had moved little. One ARM in the south end group was turned on its side. Only two *Haliotis rufescens* were found in the 13 ARMs this year. Both were relatively large (for abalone found in the ARMs), measuring 156 and 160mm. We believe these were the same abalone found last year measuring 150, and 156mm that were found in the same ARMs (#2398 and #2411). *Crassidoma (Hinnites) giganteum* were less common than last year but similar to previous years with 0.38/ARM. *Asterina (Patiria) miniata* were rare with only three found in the ARMs this year (0.23/ARM), noticeably lower than the previous four years. Seven *Pisaster giganteus* (0.54/ARM) and two *Pycnopodia helianthoides* (0.15/ARM) were found, both are low densities compared to previous years. *Cypraea spadicea* were more abundant than usual with a mean of 5.5/ARM. The *C. spadicea* at this site are larger on average (mean size 48mm) than other sites. The number of *Strongylocentrotus purpuratus* in the ARMs continued to decrease, while *S. franciscanus* remained about the same. The mean numbers per ARM this year were 3.6/ARM and 20/ARM respectively.

### **Location: Johnson's Lee South, Santa Rosa Island**

1997 sampling dates: 7/7, 7/8, 9/10.

1997 status: Mature kelp forest.

The most notable change at this site since last year was the decrease in understory red algae. *Macrocystis pyrifera* canopy was thicker than last year and was estimated to cover 60% of the transect. The canopy appeared to cover a larger area than the past several years with an abundance of *M. pyrifera* around the entire Johnson's Lee area. About half of the *M. pyrifera* plants appeared healthy, while the other half had a moderate to heavy load of epiphytic bryozoans (*Membranipora sp.*) and hydroids (*Obelia sp.*). Adult *M. pyrifera* densities increased from last year, while subadult and juvenile densities decreased. This year's densities were 0.44/m<sup>2</sup>, 0.095/m<sup>2</sup>, and 0.042/m<sup>2</sup> respectively, and coverage on the bottom

decreased to 19%. It is common for percent cover of *M. pyrifera* to decrease when there are fewer smaller and more larger plants. Adult density of *Laminaria farlowii* was similar to last year, but there were fewer juveniles. Adult and juvenile densities were 0.33/m<sup>3</sup> and 0.38/m<sup>2</sup> respectively, and coverage on the bottom was recorded at 11%, its highest recorded coverage for *L. farlowii* at this site. Young adult *Pterygophora californica* and *Eisenia arborea* were common, but none were observed on quadrats. No *Cystoseira* sp. was observed. *Dictyoneuropsis reticulata* was also common. There was notably less red algae at this site this year. Miscellaneous red algae coverage was 34%, its lowest coverage since 1993. Some of the most common species were *Polyneura latissima*, *Callophyllis* sp., *Rhodomenia californica*, and *Faucheia* sp.. Coverage of *Gigartina* spp. also decreased, and was recorded at 2.0%. The lower coverage of understory algae made it much easier to find the transect and conduct sampling. Both articulated and encrusting coralline coverage's decreased since last year. Articulated coralline coverage was 3.0%, its lowest coverage since 1987, and encrusting coralline coverage was 5.0%, its lowest coverage recorded at this site. Bare substrate covered 20% of the bottom.

During our second visit to this site on September 10<sup>th</sup>, the *Macrocystis pyrifera* did not appear as healthy. We estimated that only about 30% of the blades appeared healthy. The remainder of the blades were tattered and had an abundance of the epiphytic bryozoan, *Membranipora* sp. growing on them. The hydroid, *Obelia* sp. were also present on the blades, but they were not particularly abundant.

Similar to last year, hydroids (mostly *Aglaophenia latirostris*) were the most common miscellaneous invertebrate on RPCs. This category covered 16% of the bottom. Overall, there was an abundance and high diversity of encrusting invertebrates covering much of the bottom, consisting mostly of sponges, tunicates and bryozoans. Tunicates and sponges covered 6.2% and 1.5% of the bottom respectively. The most abundant tunicates were *Cystodytes lobatus*, *Trididemnum opacum*, and *Didemnum carnulentum*. *Balanophyllia elegans* coverage was relatively low at this site, and was recorded at 2.3% its lowest recorded coverage. *Diopatra ornata* abundance increased, and were abundant in patches in the low lying areas around the transect, their coverage was 19%, the highest coverage recorded at this site. Bryozoans were abundant and diverse covering 17% of the bottom. *Styela montereyensis* appeared more abundant than last year with a density of 0.42/m<sup>2</sup>, and small ones were common. This year ended a gradual decline in their abundance. *Tethya aurantia* were abundant with a density of 0.15/m<sup>2</sup>. *Lophogorgia chilensis* were moderately abundant with a density of 0.14/m<sup>2</sup>. *Tealia lofotensis* density has gradually declined over the past several years. This year's density was 0.047/m<sup>2</sup>, the lowest recorded since 1988. When band transects were conducted during our first visit to the site, one of the observers neglected to count *T. lofotensis*. On September 10<sup>th</sup> we re-sampled the 10 band transects that *T. lofotensis* were not counted on, on July 8<sup>th</sup>. From the data collected on September 10<sup>th</sup> we entered only the *T. lofotensis* counts. All other species counted on September 10<sup>th</sup> were similar to the July 8<sup>th</sup> sampling.

We collected a small jellyfish from one of the kelp fronds near the surface and brought it to the University of California at Santa Barbara for identification. It was a species of *Ballentenia* sp. These jellyfish often attach themselves to kelp blades and use their tentacles to crawl around feeding on mysids and similar prey items.

*Strongylocentrotus franciscanus* and *S. purpuratus* were common in crevices, but their overall densities were low at 0.0/m<sup>2</sup> and 1.3/m<sup>2</sup> respectively. Both large and small *Pycnopodia helianthoides* were more abundant than last year with a density of 0.031/m<sup>2</sup>. *Asterina (Patiria) miniata* were abundant as usual for this site, with a density of 2.8/m<sup>2</sup>. *Pisaster giganteus* were common and were counted on both quadrats and 5-meter quadrats with densities of 0.29/m<sup>2</sup> and 0.045/m<sup>2</sup> respectively. *Parastichopus parvimensis* were relatively uncommon as usual for this site with a density of 0.13/m<sup>2</sup>. On September 10<sup>th</sup>, several *Asterina (Patiria) miniata*, several *Dermasterias imbricata* and one *Pisaster giganteus* were observed with wasting disease.

On July 7<sup>th</sup>, one of the divers conducting the 5-meter quadrats neglected to count *Pisaster giganteus*. This data was not entered in the database, so there are only 20 quadrats present for *P. giganteus* counts instead of the normal 40 for this date. On September 10<sup>th</sup> we conducted 5-meter quadrats for a second time and added the data to the database. So, for 1997 there are two sets of data for this technique. Both adult and subadult *Macrocystis pyrifera* densities were similar, but there was some difference in the *Pisaster giganteus* densities.

Only two *Haliotis rufescens* were observed during band transects, 0.0028/m<sup>2</sup>. Abalone shells were collected, measured and disposed of off the transect, one fresh *H. rufescens* shell was found. During size frequency measurements for abalone, we were only able to locate 14 *Haliotis rufescens*, and one large *Haliotis corrugata* (179mm). We collected one large *H. rufescens* (214mm) that had a shrunken foot and was weak. *Crassedoma (Hinnites) giganteum* were common, their density was 0.011/m<sup>2</sup>. Nudibranchs were common and diverse.

During our first visit on July 7<sup>th</sup>, we conducted fish transects at 1538 under sunny skies. *Oxyjulis californica*, *Damalichthys vacca*, *Chromis punctipinnis*, and female *Semicossyphus pulcher* were all common. *Coryphopterus nicholsii* were relatively uncommon along the transect with a density of 0.0833/m<sup>2</sup>. Fish were abundant at the site on September 10<sup>th</sup>, but there were few fish of sport or commercial interest. Several small groups of Rainbow surfperch, *Hypsurus caryi*, and schools of Jack Mackerel, *Trachurus symmetricus*, were observed. One *Sebastes serranoides*, one adult *Paralabrax clathratus*, several female and one male *Semicossyphus pulcher* were observed. Juvenile *Sebastes* spp. were common with both *S. mystinus* and *S. atrovirens* juveniles being identified. *Embiotoca lateralis* were

moderately abundant, and *E. jacksoni* were common. Roving diver fish counts were conducted once on July 7<sup>th</sup> with seven divers observing 23 species.

All seven ARMs were located and sampled for all indicator species. New stainless steel number tags were placed on two ARMs where tags were missing. The replacement numbers are 2400 and 2401 replacing 2334 and 2337. All of the ARMs seem to be stable and have not moved since last year. We found several piles of bricks that were from the ARMs that were destroyed two years ago. These bricks were several meters off the line at the 56 and 82 meter mark.

The ARMs at this site contained few indicator species in them, however this seems to be normal for this site. No *Haliotis spp.* were found in the ARMs. *Asterina (Patiria) miniata* were moderately abundant with a mean of 7.1/ARM. *Pisaster giganteus* and *Pycnopodia helianthoides* were common with 2.4/ARM and 1/ARM respectively. *Strongylocentrotus purpuratus* were uncommon with 1.6/ARM. *S. franciscanus* were more abundant than previous years with 29/ARM. This is a relatively large increase in the number of *S. franciscanus*/ARM, however the mean size (60mm) remains similar to last year (56mm), and few juveniles were present. This implies that the urchins are immigrating into the ARMs as opposed to recruiting.

In the ARMs, three Heart crabs, *Phyllolithodes papillosus* were found. This is the first time we have observed these crabs, and this observation appears to be a small increase in their range. According to Jensen, 1995, the southernmost range of this species is San Miguel Island. The crabs ranged in size from approximately 25-75mm in carapace length.

Both temperature loggers were working when we retrieved them, however the Stowaway logger #2904 could not be down loaded. The data from the backup Hobotemp (logger #2417) was used.

The zero end eyebolt could not be located. If we can not find it on our next visit it will need to be replaced. On July 7<sup>th</sup> 1997, we found a dive slate and caliper (in different areas) that were dropped by one of our divers last year. The caliper was almost completely rusted, but the dive slate still had the readable numbers of the *Tethya aurantia* that the diver was measuring. We entered the data as last years.

### **Location: Rodes Reef, Santa Rosa Island**

1997 sampling dates: 7/22, 7/23, 8/19.

1997 status: Open area with a moderate amount of understory red algae, and scattered *Macrocystis pyrifera* plants.

Overall, this site appeared similar to the past several years except for a notable increase in brown algae. There was a small *Macrocystis pyrifera* forest just east of the transect and appeared to be expanding towards the transect. *M. pyrifera* canopy cover over the transect was estimated at 5%. All of the *M. pyrifera* plants (over 1m tall) within approximately 10 meters of the transect line were measured for size frequencies, the total was 77 plants. Although juvenile, subadult and adult *M. pyrifera* were all present within 10 meters of the transects, there were few plants directly along the line. Densities for the three categories were 0.13/m<sup>2</sup>, 0.01/m<sup>2</sup> and 0.0/m<sup>2</sup> respectively. On RPCs, *M. pyrifera* covered 0.67% of the bottom. Most of the *M. pyrifera* appeared healthy, but some of the plants had a small infestation of kelp curler amphipods, *Amphithoe humeralis*. *Idotea ressecata* were common on the kelp stipes. During our second visit to the site just several weeks later on August 19<sup>th</sup>, the *M. pyrifera* did not appear as healthy.

There was a notable increase of understory brown algae this year. *Desmarestia* sp. was the most abundant covering 17% of the bottom. *Laminaria farlowii* was common covering 1.8% of the bottom, and adult and juvenile densities were 0.042/m<sup>2</sup>, and 0.13/m<sup>2</sup>. One small adult *Eisenia arborea* was observed on quadrats (0.042/m<sup>2</sup>), and coverage was recorded at 0.67%. *Cystoseira* sp. was less abundant than last year, and it was rare directly along the transect (0.17%) where sampling is conducted. Miscellaneous brown algae covered 2.0% of the bottom. Small clumps of the brown algae, *Pachydictyon/Dictyota* were common. Typical for this site miscellaneous red algae was abundant and diverse covering 62% of the bottom. Species of red algae most abundant were *Polyneura latissima*, *Callophyllis crenulata*, *Rhodomenia californica*, *Nienburgia andersoniana*, and *Acrosorium* sp.. Articulated coralline was uncommon, and encrusting coralline algae covered 51% of the bottom. Bare substrate covered 24% of the bottom, the highest coverage recorded for this site since monitoring began.

The most common miscellaneous invertebrates on RPCs were *Chaetopterus variopedatus*, and hydroids. This category covered only 2.3% of the bottom, much lower than the previous several years, and the lowest recorded coverage for this site. *C. variopedatus* was again notably less abundant than the previous three years. *Diopatra ornata* also appeared to be less abundant and decreased in coverage to 1.0%, its lowest coverage since 1987. The decrease in these two species of worms probably accounts for the increase in bare substrate. *Astrangia lajollaensis* and *Balanophyllia elegans* were more abundant on the western/rocky end of the transect and covered 4.6% and 2.3% of the bottom respectively. Bryozoans were common and covered 9.4% of the bottom combined. *Telia lofotensis* were common (0.051/m<sup>2</sup>) on top of rocks. *T. coriacea* and *T. colombiana* were also common. *Lophogorgia chilensis* were uncommon, and none were observed on band transects. *Styela montereyensis* were common, and were recorded at a similar density as last year, 0.25/m<sup>2</sup>. *Tethya aurantia* were abundant with a density of 0.18/m<sup>2</sup>. The gray puffball sponge, *Tetilla arb.* was also abundant. A bright orange encrusting tunicate was common and was often found covering entire rocks. These rocks appeared as if they were painted with bright orange paint.

*Strongylocentrotus franciscanus* were moderately abundant with a density of 4.5/m<sup>2</sup>. *S. franciscanus* were notably more abundant along the eastern end of the transect compared to previous years, but were mostly present under small ledges and in cracks and crevices. On the west end of the transect many of the large *S. franciscanus* are in the open on top of rocks. Small *S. franciscanus* under the spine canopy of conspecifics and in crevices were more abundant on the eastern end of the transect. Overall, juvenile *S. franciscanus* were moderately abundant. *S. purpuratus* were less abundant than *S. franciscanus*, with a density 1.9/m<sup>2</sup>. Most of the *S. purpuratus* were present on the western end of the transect. *Lytechinus anamesus* were rare with a density of 0.072/m<sup>2</sup>. Large *Parastichopus parvimensis* were present on the western/rocky half of the transect, however none were observed on quadrats.

As usual, sea stars were abundant at this site. *Asterina (Patiria) miniata* were abundant with a density of 3.0/m<sup>2</sup>. On July 22<sup>nd</sup> three *Asterina (Patiria) miniata* were observed that may have had wasting disease or were dying of another cause such as predation, and on August 18<sup>th</sup>, one *P. miniata* was observed with wasting disease. Overall, *Pisaster giganteus* were common and were counted on both quadrats (0.42/m<sup>2</sup>) and 5-meter quadrats (0.21/m<sup>2</sup>), they were more abundant on the rocky/western end of the transect. *Pycnopodia helianthoides* were rare with a density of 0.0097/m<sup>2</sup>. They were notably less abundant than last year, and only six were found for size frequency measurements. *Dermasterias imbricata* (leather star), *Henricia leviuscula* (blood stars), *Henricia sp.*, and *Pisaster brevispinus* (short spined sea star) were all common. Only a few *Mediaster aequalis* (red sea star) were observed and were notably less abundant than last year. *Orthasterias koehleri* (rainbow stars) were rare.

*Kelletia kelletii* were less abundant than the last three years, with a density of 0.011/m<sup>2</sup>. Several *Lithopoma (Astraea) undosum* and *L. (A.) gibberosa* were observed along the transect. *L. undosum* were enumerated in quadrats, but *A. gibberosa* was not. *Megathura crenulata* were common on the western/rocky end of the transect, their density was 0.011/m<sup>2</sup>. *Aplysia californica* were common with a density of 0.011/m<sup>2</sup>. One small (10mm) *Haliotis rufescens* was found under the spine canopy of a large *Strongylocentrotus franciscanus*. Mysids were common on the bottom. The coon-striped shrimp, *Pandalus danae*, were common.

Fish were abundant and diverse at this site and were congregated mostly on the western end of the transect as usual for this site. The most abundant fish were adult and juvenile *Embiotoca lateralis*, small *Damalichthys vacca*, and large male and female *Semicossyphus pulcher*. *Paralabrax clathratus*, *Embiotoca jacksoni*, *Chromis punctipinnis*, *Oxylebius pictus* (painted greenlings), *Sebastes atrovirens*, and *S. serranoides* were all common. Several groups of about 10-20 *S. atrovirens* were observed. *Oxyjulis californica* were relatively uncommon. *Coryphopterus nicholsii* were relatively uncommon, and none were observed on quadrats. *Caulolatilus princeps* (Ocean whitefish), *Pleuronichthys coenosus*, (c-o turbot),

were also common. Parasitic copepods were abundant on male *S. pulcher*, and were also observed on other fish. On August 19<sup>th</sup> we observed several juvenile *Sebastes miniatus* (vermillion rockfish).

On July 22<sup>nd</sup>, fish transects were conducted at 1530, under sunny sky's. Although there were few fish counted during the fish transects, fish were abundant and diverse at this site as shown by the roving diver fish count conducted immediately after the fish transects. The next day, I swam along the transect during mid-day to see if the fish transects would have been any different. Although the actual transects were not conducted, it appeared that the counts would have changed little. The roving diver fish count on July 22<sup>nd</sup> was conducted with seven divers observing 26 species

The lead line was attached to the new eyebolts installed last year. Overall, the lead line is in good condition.

There were 2-6 commercial fishing boats observed fishing around the Rodes Reef area on July 22<sup>nd</sup>, and July 23<sup>rd</sup>. One of the boats appeared to be using gill nets, and was working at the one mile line.

#### **Location: Gull Island South, Santa Cruz Island**

1997 sampling dates: 7/21, 7/22, 8/18.

1997 status: *Strongylocentrotus purpuratus* barrens.

Overall, this site has changed little and continues to be mostly dominated by *Strongylocentrotus purpuratus*. Algae was more abundant than last year. Most of the increase consisted of miscellaneous red algae (mostly filamentous) and other plants (filamentous diatoms). These categories covered 8.3% and 16% of the bottom, respectively. A few small subadult *Macrocystis pyrifera* plants were present on top of the large rock on the southern end of the transect. Also on top of this rock were some *Gelidium purpurescens* and several juvenile *Eisenia arborea*. Several juvenile *E. arborea* and single blade (small juvenile) *M. pyrifera* were observed along the transect. Juvenile *E. arborea* and *M. pyrifera* had low densities along the transect, 0.042/m<sup>2</sup> and 0.083/m<sup>2</sup> respectively. *Colpomenia* sp. and *Halicystis ovalis* were common. Articulated coralline algae was uncommon at 0.5% coverage, and was often covered with filamentous diatoms. Encrusting coralline algae was abundant covering 63% of the bottom. Bare substrate covered 12% of the bottom. There were several small patches of canopy forming *M. pyrifera* inshore of the transect and at the southeastern end of Gull Island.

On RPCs, the most common miscellaneous invertebrates were the worm *Pista elongata*, hydroids and the Christmas tree worm, *Spirobranchus spinosus*. This category covered 14% of the bottom. *Corynactis californica* was common covering 1.6% of the bottom. *Balanophyllia elegans* and *Astrangia lajollaensis*



were moderately abundant covering 4.5% and 4.3% of the bottom respectively. *Diopatra ornata* were present in the low-lying sandy areas of the transect, but did not appear as abundant as last year. None were observed along the transect during RPCs. Bryozoans combined covered 4.8% of the bottom, similar to last year. *Stylaster (Allopora) californica* density was similar to previous years, 0.056/m<sup>2</sup>, and both small and large colonies were present. *Lophogorgia chilensis* were abundant with a density of 0.15/m<sup>2</sup>.

*Strongylocentrotus franciscanus* and *S. purpuratus* densities were relatively high (6.4/m<sup>2</sup> and 30/m<sup>2</sup> respectively) and have remained virtually the same since 1995. *S. purpuratus* were more abundant and smaller on the northern end of the transect, as is usual for this site. Similar to last year, juvenile *S. franciscanus* and *S. purpuratus* were rare. Unlike last year, *Lytechinus anamesus* were common with a density of 1.9/m<sup>2</sup> on band transects. Several *S. purpuratus* and *L. anamesus* were observed with wasting syndrome. Whole *S. purpuratus* tests were common. Of 197 *S. purpuratus* collected for size frequencies, 19 were identified with wasting syndrome, and of the 227 *L. anamesus* collected, 24 were identified with wasting syndrome.

*Asterina (Patiria) miniata* were moderately abundant with a density of 2.0/m<sup>2</sup>. *Pisaster giganteus* were common and counted on both quadrats and 5-meter quadrats, with densities of 0.33/m<sup>2</sup> and 0.21/m<sup>2</sup> respectively. *Pycnopodia helianthoides* were less abundant than last year, and were rare along the transect with a density of 0.0028/m<sup>2</sup>. *Parastichopus parvimensis* density was 0.58/m<sup>2</sup>. We observed no sea star wasting disease during our first visit on July 21<sup>st</sup>. Just four weeks later we observed numerous *Asterina (Patiria) miniata* with wasting disease, some of these were almost completely disintegrated. *Pisaster giganteus* were also observed with this disease in moderate numbers.

*Cypraea spadicea* were notably abundant in quadrats this year. Their density was recorded at 1.2/m<sup>2</sup>, the highest density recorded at this site. *Lithopoma (Astraea) undosum* density was 0.17/m<sup>2</sup>. *Megathura crenulata* were common with a density of 0.061/m<sup>2</sup>. *Kelletia kelletii* were relatively uncommon at this site with a density of 0.0069/m<sup>2</sup>, their lowest recorded coverage. *Aplysia californica* were relatively common for this site with a density of 0.026/m<sup>2</sup>, similar to last year. One *Haliotis rufescens* and one *H. corrugata* fresh shells were found, both measured approximately 25mm. No live *Haliotis* sp. were found outside of the ARMs. One live *Erato vitellina* was observed.

Overall, fish appeared less abundant than last year. *Chromis punctipinnis* were common. Female *Semicossyphus pulcher* were common and one male was seen, all were very small. One juvenile *S. pulcher* was observed. *Sebastes serranoides* were rare, and only one was observed during the roving diver fish count on August 18<sup>th</sup>, last year they were common. *S. atrovirens* were common. *Oxyjulis californica* were rare and no *Halichoeres semicinctus* were observed during the roving diver fish counts. *Coryphopterus nicholsii* were common with a density of 0.54/m<sup>2</sup>. *Alloclinus holderi* were relatively

common for this site with a density of 0.21/m<sup>2</sup>. Juvenile (probably young-of-year), *Sebastes mystinus* were common, but no adults were observed. Roving diver fish counts were conducted on July 21<sup>st</sup> with four divers observing 17 species and on August 18<sup>th</sup> with eight divers observing 17 species.

There are three groups of five ARMs at this site. Thirteen ARMs were monitored for all indicator species; four from the north and middle groups, and five from the south group. The remaining two ARMs were sampled for all indicator species except sea urchins. Many of the ARM cages are starting to rust out and need replacing as soon as possible.

More *Haliotis rufescens* were found in the ARMs than the last several years. Five were found this year and all were less than 28mm. One *H. corrugata* was found measuring 29mm. *Cypraea spadicea* were common with similar numbers to previous years (5.9/ARM). Small *Megathura crenulata* were relatively common with 0.47/ARM. *Asterina (Patiria) miniata* were less abundant than last year, but still common with 3.9/ARM. *Pisaster giganteus* were common, similar to previous years with 0.93/ARM. The number and size of *Strongylocentrotus franciscanus* and *S. purpuratus* were similar to last year, with 24/ARM and 52/ARM respectively.

The temperature logger battery prematurely failed, and the unit stopped recording data on July 1<sup>st</sup>, 1997.

**Location: Fry's Harbor, Santa Cruz Island**

1997 sampling dates: 7/11, 8/7.

1997 status: Open area with high densities of aggregating red sea cucumbers, *Pachythyone rubra*, *Ophiothrix spiculata*, *Astrangia lajollaensis* and *Strongylocentrotus purpuratus*.

Overall, this site has changed little from last year. *Macrocystis pyrifera* was absent, and there continues to be little other foliose algae. As usual, there were several adult *Eisenia arborea* plants on top of the large boulder at the north end of the transect, but none were in quadrats. Adult and juvenile *E. arborea*, and several adult *Laminaria farlowii* were on top of the giant boulder in the middle of the south side of the transect. Off the transect, *E. arborea* was common along the wall in shallower water. The only other algae along the transect were filamentous red and green algae, and some filamentous brown (diatoms). Not including coralline algae, all algae combined covered only 5.5% of the bottom and were mostly filamentous. Articulated coralline was rare covering only 1.0% of the bottom. Encrusting coralline algae covered 26% of the bottom. Bare substrate covered 18% of the bottom and was most prominent along the middle of the transect.

The most common miscellaneous invertebrates on RPCs were the brittle star, *Ophiothrix spiculata*, *Lophogorgia chilensis* and a small unidentified anemone. During RPCs *O. spiculata* was counted separately and then added to the miscellaneous invertebrate category. Combined this category covered 19% of the bottom, and *O. spiculata* was responsible for 9.7%. *Astrangia lajollaensis* were abundant covering 17% of the bottom. *Corynactis californica* were common covering 5.5% of the bottom. *Lophogorgia chilensis* were abundant on the deeper side of the transect, and their density was 0.15/m<sup>2</sup>. *Diaperoecia californica* were abundant and their coverage has increased over the last two years. Its coverage was 13%, and was the highest recorded for this species at this site. The bryozoan *Thalamoporella californica* was again uncommon along the transect, but was common along the inshore wall at a depth of about 6 meters. Miscellaneous bryozoans covered only 1.3% of the bottom. *Tethya aurantia* density was 0.014/m<sup>2</sup>.

Aside from the abundance of *Astrangia lajollaensis*, echinoderms dominate much of this site. Prior to 1995 *Pachythyone rubra* was the dominating echinoderm. Since 1995, *Strongylocentrotus purpuratus* and *Ophiothrix spiculata* are now also dominating organisms at this site. All three of these echinoderms seem to be about equal in their relative abundance, but this is a qualitative assessment.

*Pachythyone rubra* continued to dominate much of this site, covering 15% of the bottom. *P. rubra* are easily disturbed, and we were careful not to disturb the bottom before conducting RPCs along the transect. *P. rubra* were most abundant along the north and south thirds of the transect, while in the middle

third they were less abundant. *Ophiothrix spiculata* were moderately abundant, but were mostly on the southern half of the transect. As mentioned above, *O. spiculata* covered 9.7% of the bottom.

*Parastichopus parvimensis* density was 0.21/m<sup>2</sup>, relatively low for this site. *Strongylocentrotus franciscanus* were common with a density of 1.8/m<sup>2</sup>. *S. purpuratus* density was 19/m<sup>2</sup>, a small decrease from last year. *Lytechinus anamesus* were common on the deeper/offshore side of the transect, and more abundant towards the southern end. Their density was similar to last year at 0.76/m<sup>2</sup>. *Pisaster giganteus* were common, but not many were found directly along the line. They were counted on both quadrats (0.0/m<sup>2</sup>) and 5-meter quadrats (0.04/m<sup>2</sup>). *Asterina (Patiria) miniata* density have gradually increased since 1994, density this year was 1.1/m<sup>2</sup>. Sea star wasting disease was observed in both *P. giganteus*, and *P. miniata*. Sea urchin wasting syndrome was observed in *S. purpuratus*, and *L. anamesus*, but no sick *S. franciscanus* were observed. One *Pycnopodia helianthoides* was observed along the transect, but was not on band transects.

*Cypraea spadicea* and *Lithopoma (Astraea) undosum* were common with densities of 0.29/m<sup>2</sup> and 0.55/m<sup>2</sup> respectively. *Megathura crenulata* density was similar to last year, and again was relatively low at 0.060/m<sup>2</sup>. No *Aplysia californica* were observed on band transects nor during the species list survey. Nudibranchs were common. Several *Hermisenda crassicornis*, *Navanax inermis*, *Mexichromis porterae*, *Flabellina iodinea* and *Diaulula sandiegensis* were observed.

Adult *Chromis punctipinnis*, *Paralabrax clathratus*, male and female *Halichoeres semicinctus*, and female *Semicossyphus pulcher* were all common. Only one male *S. pulcher* was observed during each visit. Juvenile *Chromis punctipinnis* were common in small groups of less than 15 during our second visit on August 8<sup>th</sup>. Several *Embiotoca jacksoni*, and *Damalichthys vacca* were observed. Several rubberlip surfperch, *Rhacochilus toxotes*, were observed on the northern end of the transect. We have consistently observed several *R. toxotes* in this same area for at least several years. Several *Halichoeres semicinctus* were observed, but they are relatively uncommon. *Coryphopterus nicholsii* were abundant with a density of 1.4/m<sup>2</sup>. *Alloclinus holderi* were common, and relatively abundant for this site with a density of 0.63/m<sup>2</sup>, the highest density recorded at this site. Stripefin ronquils, *Rathbunella hypoplecta*, were common, and could possibly be confused with *Alloclinus holderi*. However, the people conducting quadrats were positive of the *A. holderi* observed. *Lythrypnus dalli* were common with a density of 0.13/m<sup>2</sup> and very small juveniles were observed during our second visit on August 8<sup>th</sup>. *Lythrypnus zebra* were also relatively common. Adult and juvenile *Sebastes serriceps* were common. One *Cephaloscyllium ventriosum* (swell shark) and one *Heterodontus francisci* (horn shark) were observed. Roving diver fish counts were conducted on July 11 with seven divers observing 22 species of fish, and on August 7 with six divers observing 28 species of fish.

All seven ARMs were intact and sampled for all indicator species. Stainless steel tags were replaced on three ARMs: new tag number 2433 replaced 2389, 2435 replaced 2385, and 2434 replaced 2386 (we were able to tell which ARM was which because the original brass tags remained on the ARMs). Two ARMs had no tags and were given new numbers 2431 and 2432 replacing either 2387 or 2390.

No *Haliotis spp.* were observed in the ARMs this year. The number of *Crassedoma (Hinnites) giganteum* found in the ARMs was low with 1/ARM. *Cypraea spadicea* were common with mean of 7.9/ARM. *Megathura crenulata* were also relatively common with 1.3/ARM. *Pisaster giganteus* were common with 2/ARM. *Asterina (Patiria) miniata* were abundant with 14/ARM, similar numbers to last year. The number of *Strongylocentrotus franciscanus* and *S. purpuratus* continued to decrease for the third consecutive year. This years density were 18/ARM and 49/ARM respectively.

The Stowaway temperature logger was not working when we retrieved it and it appears that the battery failed on June 7<sup>th</sup>, 1997. The backup Hobotemp logger was working properly so there was no temperature data loss for the almost 12 months these units were deployed at this site.

#### **Location: Pelican Bay, Santa Cruz Island**

1997 sampling dates: 7/24, 8/19.

1997 status: *Strongylocentrotus purpuratus* barren.

This site continues to be a barren, dominated by *Strongylocentrotus purpuratus*. One *Eisenia arborea* was observed along the transect, however it was common in the shallower areas above the transect. There was a small amount of *Laurencia pacifica* on top of rocks. No algae was recorded on quadrats. Other than coralline algae, the only algae recorded on RPCs was miscellaneous red algae at a coverage of 2.2%. Articulated coralline algae coverage was low at 0.12%. Encrusting coralline algae coverage was also relatively low at 19%. Bare substrate was abundant covering 41% of the bottom. The lead line and many of the eyebolts at this site need repairs.

The most notable change at this site were the increase of barnacles (probably *Balanus sp.*) on the rocky substrate. They were the most abundant miscellaneous invertebrate on RPCs, and it was estimated that they were responsible for at least 95% of this category that covered 24% of the bottom. Terebellid worms were common, but not nearly as abundant as last year when they made up most of the miscellaneous invertebrate category. As usual, *Astrangia lajollaensis* were abundant covering 15% of the bottom. *Serpulorbis squamigerus* were common on the top of large rocks, however their overall coverage directly along the transect was only 0.17%. Bryozoans were rare along the transect, and none were observed on

RPCs. Most of the *Lophogorgia chilensis* are present on the deeper/offshore side of the transect, and small individuals were common, their density was 0.075/m<sup>2</sup>.

*Strongylocentrotus purpuratus* were abundant and dominated the site with a density of 32/m<sup>2</sup>. Their density has remained high for the past four years. *S. franciscanus* density was 1.9/m<sup>2</sup>. *Lytechinus anamesus* were counted on both quadrats and band transects. Their densities were 0.46/m<sup>2</sup>, and 0.32/m<sup>2</sup> respectively. Juvenile *Strongylocentrotus* spp. and *Lytechinus anamesus* were rare. It was common to see all three species of sea urchins with wasting syndrome, and whole tests from each species were common indicating recent mortality. *Centrostephanus coronatus* were common along the transect, but none were observed in quadrats. Small and medium sized *Parastichopus parvimensis* were common with a density of 0.50/m<sup>2</sup>, an increase from last year. *Asterina (Patiria) miniata* and *Pisaster giganteus* had low densities as usual for this site. Their densities were 0.13/m<sup>2</sup> and 0.083/m<sup>2</sup> respectively. *P. giganteus* were also counted on 5-meter quadrats, with a density of 0.045/m<sup>2</sup>. We observed *P. miniata* with sea star wasting disease during both visits to this site. Wasting disease was much more prevalent in *P. miniata* during our second visit on August 19<sup>th</sup>. *P. giganteus* was observed with sea star wasting disease only on our second visit. There appeared to be more *S. purpuratus* infected with sea urchin wasting syndrome on our second visit.

*Crassedoma (Hinnites) giganteum* were common with a density of 0.093/m<sup>2</sup>. *Aplysia californica* were more common than last year with a density of 0.015/m<sup>2</sup>. *Lithopoma (Astraea) undosum* were common with a density of 1.3/m<sup>2</sup>. *Kelletia kelletii* density was 0.011/m<sup>2</sup>. A fresh *Pecten diegensis* shell was found.

*Hypsypops rubicundus*, *Embiotoca jacksoni*, *Damalichthys vacca*, and small *Paralabrax clathratus* were all common. One small *Gymnothorax mordax* was observed. *Pleuronichthys coenosus*, c-o turbot, were common. Several small female and one small male *Semicossyphus pulcher* were observed. One large male *S. pulcher* was observed on August 19<sup>th</sup>. *Halichoeres semicinctus* were rare and few were observed. *Lythrypnus dalli* were common, but less abundant than last year with a density of 0.17/m<sup>2</sup>. Zebra gobies, *Lythrypnus zebra*, were common. *Coryphopterus nicholsii* were abundant, but less than last year with a density of 4.4/m<sup>2</sup>. *Alloclinus holderi* were more abundant than last year with a density of 0.833/m<sup>2</sup>, their highest recorded density at this site. Fish diversity at this site was relatively high, with 28 species observed by eight divers during the roving diver fish count conducted on July 24<sup>th</sup>, and 23 species observed by nine divers on August 19<sup>th</sup>.

All six ARMs were sampled for all indicator species. Several of the ARMs had cages that were in a deteriorated state and two cages were replaced. Several broken bricks from various ARMs were replaced using bricks from the ARM crushed in 1995-96. ARM debris was removed and disposed of properly.

Overall, the ARMs were bare and had little growing on or in them. No *Haliotis* spp. were found in the ARMs. *Cypraea spadicea* were common with a mean of 6.7/ARM. Only one large (127mm) *Crassedoma (Hinnites) giganteum* was found in the six ARMs. *Asterina (Patiria) miniata* were relatively abundant in the ARMs for this site. The mean number was 9.2/ARM, the highest recorded. Only six *Pisaster giganteus* were found (1/ARM), similar to last year. The number of *Strongylocentrotus franciscanus* was similar to last year with a mean of 14/ARM. The number of *S. purpuratus* continued to decline, but not as much as the previous year, their mean was 28/ARM this year. Small, less than 15mm *S. purpuratus* and *S. franciscanus* were rare this year, indicating little recruitment.

### **Location: Scorpion Anchorage, Santa Cruz Island**

1997 sampling dates: 7/24, 8/8, 8/22.

1997 status: *Strongylocentrotus purpuratus* barrens.

This area continues to be a barren, dominated by *Strongylocentrotus purpuratus*. This year there was virtually no macroalgae, and the kelp forest southwest of the transects has decreased in size. Several small juvenile (single blade) *Macrocystis pyrifera* were observed on the top of rocks. Aside from coralline algae, most of the algae recorded along the transect consisted of miscellaneous red algae and other plants (diatoms). Their coverage's were 2.2% and 2.8% respectively, and were dominated by filamentous types. Excluding coralline algae, algae combined covered 6.1% of the bottom. Articulated and encrusting coralline algae coverage was similar to last year covering 1.2% and 53% of the bottom respectively. Bare substrate coverage was also similar at 31%.

The most common miscellaneous invertebrates on RPCs were the Christmas tree worm, *Spirobranchus spinosus*. This category covered 13% of the bottom. *Serpulorbis squamigerus* were common covering 1.2% of the bottom. Overall, bryozoans were uncommon, but some were present on the top of rocks. *Diaperoecia californica* coverage was 1.2%.

*Strongylocentrotus purpuratus* were abundant with a density of 48/m<sup>2</sup>, similar to previous years. *S. franciscanus* were common with a density of 1.3/m<sup>2</sup>, similar to the past two years. No *Lytechinus anamesus* were observed on quadrats and band transects. *Strongylocentrotus* spp. were out in the open and not confined to crevices. Juvenile *S. franciscanus* and *S. purpuratus* were rare. Both *S. franciscanus* and *S. purpuratus* were observed with wasting syndrome. *Asterina (Patiria) miniata* were common with a density of 0.33/m<sup>2</sup>. *Pisaster giganteus* were uncommon and none were observed on quadrats and 5m-quadrats. Several *P. miniata* and one *P. giganteus* were observed with wasting disease. *Parastichopus parvimensis* density was 0.29/m<sup>2</sup>.

*Aplysia californica* density was 0.018/m<sup>2</sup>. *Megathura crenulata* were common with a density of 0.074/m<sup>2</sup>. *Lithopoma (Astraea) undosum* were abundant with a density of 2.8/m<sup>2</sup>. *Crassedoma (Hinnites) giganteum* were common with a density of 0.067/m<sup>2</sup>. *Panulirus interruptus* were common, and four (0.0056/m<sup>2</sup>) were observed on band transects. Several of the *P. interruptus* were estimated to be legal size.

Overall, fish were uncommon at this site. *Chromis punctipinnis*, *Oxyjulis californica*, *Paralabrax clathratus*, *Halichoeres semicinctus*, and *Hypsypops rubicundus* were relatively uncommon. No *Semicossyphus pulcher* were observed. *Coryphopterus nicholsii* density was 1.3/m<sup>2</sup>. *Alloclinus holderi* were common with a density of 0.46/m<sup>2</sup>, their highest density recorded at this site. Several juvenile *Sebastes serriceps* were observed. Several bat rays, *Myliobatis californica*, were observed and there was evidence of predation on *Lithopoma (Astraea) undosum* by them or horn sharks, *Heterodontus francisci*. The roving diver fish count on July 24<sup>th</sup>, was conducted with seven divers observing 24 species of fish.

All seven ARMs were sampled for all indicator species. The ARMs were relatively bare and contained few indicator species. *Cypraea spadicea* were abundant with 16/ARM, an increase from last year. The number of *Crassedoma (Hinnites) giganteum* was similar to last year, but fewer small ones were observed. The mean this year was 3.1/ARM. *Asterina (Patiria) miniata* were relatively uncommon with a mean of 1/ARM, similar to previous years. The mean number of *Strongylocentrotus franciscanus* and *S. purpuratus* decreased from last year. Their mean numbers were 3.6/ARM and 29/ARM respectively. Juvenile (less than 15mm) *S. purpuratus*, and *S. franciscanus* were rare.

On December 5<sup>th</sup>, 1997 the Scorpion Ranch area at Santa Cruz Island experienced 11 inches of rain in a 24 hour period causing mass flooding. This flood deposited much sediment into Scorpion's Anchorage. On December 15<sup>th</sup>, we conducted a survey of the area to see what the impacts of the flood was. Overall, kelp forest monitoring transect did not appear to be impacted by the flood. There was no significant deposition of silt along the transect, but a thin layer was evident upon sweeping ones hand across the hard substrate. On this date we observed several *Patiria miniata*, all of which were healthy with no signs of wasting disease. Sea urchin wasting disease was common, afflicting an estimated less than 5% of the *Strongylocentrotus purpuratus*. No *S. franciscanus* were observed with this syndrome. The ARMs appeared in good condition, except #2426 was turned on its side, this one was turned upright. The kelp forest just southwest of the transect continued to deteriorate since our last visit on August 22<sup>nd</sup>. Only several *Macrocystis pyrifera* and *Laminaria farlowii* plants were present. All of these were located on top of large boulders and were tattered appearing relatively unhealthy, and most were actively being fed upon by sea urchins.



**Eelgrass beds off Scorpion Ranch:** During the flood assessment dive mentioned above on December 15<sup>th</sup> we assessed the impacts on the eelgrass beds just off Scorpion Ranch. As a result of the flood, large amounts of sediment were observed having been deposited over most of the area in the anchorage. Near the mooring buoy, eelgrass, *Zostera sp.*, was buried about half the length of the blade, approximately 20 cm. The average depth of sediment was estimated to be around 10-15 cm, but we did find some eelgrass beds that were both nearly and completely covered with an estimated 50 cm of sand and silt.

**Location: Yellowbanks, Santa Cruz Island**

1997 sampling dates: 8/4, 8/5, 8/18, 8/21, 9/8, 9/9.

1997 status: Kelp forest with a abundance of understory brown algae.

Similar to last year, most of the Yellowbanks area appears to have much less *Macrocystis pyrifera* than normal. However, the transect and the areas near the transect appear to have more *M. pyrifera* than the surrounding areas. *M. pyrifera* canopy cover was estimated at 30% and was thin at slack tide. Adult, subadult and juvenile *M. pyrifera* plants were all present along the transect. Their densities were 0.04/m<sup>2</sup>, 0.39/m<sup>2</sup> and 1.0/m<sup>2</sup> respectively. Large adult plants were common, however there were few directly along the transect resulting in low adult densities. *M. pyrifera* coverage on RPCs was similar to previous years at 12%. Most of the *M. pyrifera* plants appeared healthy with healthy blades and only a small amount of the epiphytic hydroid, *Obelia sp.*, growing on them.

Surprisingly the *Macrocystis pyrifera* at this site appeared relatively healthy during our last visit on September 8<sup>th</sup> visit. Due to the unusually warm water temperatures at the site of 21-23 °C, we would have expected the kelp to not appear as healthy. We estimated that about half of the blades were tattered, while the other half appeared healthy..

Overall, understory brown macroalgae were abundant along the transect, but were mostly along the inshore/north side of the transect. *Eisenia arborea* were present, but relatively uncommon. Adult and juvenile densities were 0.042/m<sup>2</sup> and 0.083/m<sup>2</sup> respectively, and only covered 0.33% of the bottom. Adult and juvenile *Pterygophora californica* were abundant along the transect, especially along the inshore/north side. Their densities were 1.3/m<sup>2</sup> and 1.0/m<sup>2</sup> respectively, and covered 25% of the bottom. Adult and juvenile *Laminaria farlowii* were also moderately abundant with densities of 0.29/m<sup>2</sup> and 1.1/m<sup>2</sup> respectively, and covered 16% of the bottom. *Cystoseira Spp.* was common covering 16% of the bottom. Miscellaneous brown algae was relatively abundant for this site, and consisted mostly of *Dictyota/Pachydictyon*, this category covered 14% of the bottom. Miscellaneous red algae was less common than last year with a coverage of 2.5%. Miscellaneous plants were abundant and consisted of filamentous brown diatoms. This category covered 26% of the bottom, its highest coverage recorded at this site. Articulated and encrusting coralline algae covered 18% and 50% of the bottom respectively. Bare substrate covered 30% of the bottom.

During our last visit to this site on September 8<sup>th</sup>, understory algae remained abundant and consisted mostly of brown algae. Brown filamentous diatoms were notably abundant covering much of the bottom.

The most common miscellaneous invertebrates on RPCs were hydroids and the worm, *Pista elongata*. This category covered 15% of the bottom. Bryozoans were common, but patchy, mostly occurring in areas of high relief. Combined they covered 6.5% of the bottom. *Tethya aurantia* were common on the offshore/south side of the transect with a density of 0.015/m<sup>2</sup>. *Lophogorgia chilensis* were also common on this side of the transect with a density of 0.039/m<sup>2</sup>. *Muricea californica* and *M. fruticosa* were less common with densities of 0.0028/m<sup>2</sup> and 0.0056/m<sup>2</sup> respectively.

*Strongylocentrotus franciscanus* were common with a density of 1.8/m<sup>2</sup>, and were mostly confined to crevices. Similar to last year, *S. purpuratus* were also often in crevices, however, there were several high density patches where they were found out in the open. Their density was 11/m<sup>2</sup>, similar to the past three years. *Lytechinus anamesus* were common, and were counted on band transects. Their density was 0.20/m<sup>2</sup>, and many of them were difficult to see because they were small (mean size 18mm), often covered with debris, and we experienced low visibility during sampling. *Pisaster giganteus* were uncommon, and were counted on quadrats (0.042/m<sup>2</sup>) and 5-meter quadrats (0.025/m<sup>2</sup>). Similar to last year, there appeared to be more *Asterina (Patiria) miniata* than usual for this site. Their density was 0.25/m<sup>2</sup>, the highest recorded for site. *Parastichopus parvimensis* were common with a density of 0.58/m<sup>2</sup>.

No sea urchin wasting syndrome, and sea star wasting disease were observed until our last visit to this site on September 8<sup>th</sup>. On this date sea star wasting disease was observed in *Asterina (Patiria) miniata*, *Dermasterias imbricata*, and *Mediaster aequalis*. Only five of the 24 *Asterina (Patiria) miniata* located for size frequencies were healthy. The remaining 19 were in various stages of wasting disease. Not included in these numbers were the already dead *A. miniata* that were present at the site as piles of ossicles in the shape of *A. miniata*. Only one *Pisaster giganteus* was observed and it appeared healthy. It is interesting to note that an additional 52 *A. miniata* were measured in the ARMs, and only two of these were observed with wasting disease. In other words, there was a larger proportion of healthy *A. miniata* in the ARMs than in the natural habitat. It is possible that diseased *A. miniata* are emergent and not confined to crevices. During the natural habitat sampling we do not conduct invasive sampling, only the emergent animals are counted and/or measured. In the ARMs, most of the animals that are counted/measured are inside the ARMs. These two techniques bias the samples if there is a behavioral difference among diseased sea stars.

*Lithopoma (Astraea) undosum* were common with a density of 0.54/m<sup>2</sup>. *Kelletia kelletii* were relatively common with a density of 0.024/m<sup>2</sup>. *Megathura crenulata* and *Crassedoma (Hinnites) giganteum* were relatively uncommon. Three *Haliotis corrugata* were observed on band transects (0.0042/m<sup>2</sup>).

Visibility was too poor (less than 1.3m secchi distance on bottom) on August 4<sup>th</sup> and 5<sup>th</sup> to conduct either fish transects or roving diver fish count. However, we were able to conduct quadrats, 5-meter quadrats, random point contacts, and band transects during this time. We feel we were able to conduct these adequately. We also visited this site on August 18<sup>th</sup>, and 21<sup>st</sup> and decided again that visibility was too poor to monitor fish.

On September 8<sup>th</sup>, visibility was adequate to conduct fish counts. Fish were uncommon at 1230 when fish transects and the roving diver fish count were conducted. Fish were notably more abundant later on in the day at 1730. The most abundant fish were large schools of adult and juvenile *Oxyjulis californica*. Adult *Paralabrax clathratus* were common, and juveniles were moderately abundant in the understory brown algae. A small school of juvenile *Chromis punctipinnis* were observed. Painted greenlings, *Oxylebius pictus*, were common. *Alloclinus holderi* were uncommon (0.0042/m<sup>2</sup>) and most were large. *Coryphopterus nicholsii* were common, but few (0.013/m<sup>2</sup>) were found directly along the transect. Large schools of, jack mackerel, *Trachurus symmetricus*, and sardines, *Sardinops sagax*, were present at the site. A large school of California barracuda, *Sphyræna argentea*, and several yellowtail, *Seriola lalandi*, were observed in the upper water column over the transect on August 4<sup>th</sup>.

A total of seven ARMs were monitored for all indicator species (three from the west end group, three from the middle group, and one from the east end group), and eight were monitored for all but sea urchins. The additional group of five ARMs east of the east end of the transect were monitored for abalone only. Many of the ARMs cages are heavily corroded and five cages were replaced this year. The cages were replaced on ARMs #2361, 2365, 2366, 2367, 2368. New cages are needed for ARMs # 2362 and 2355, and there may be several others that need replacing. The ARMs at this site were deployed in 1989, so it appears that the life expectancy of the cages is about eight years.

Five small *Haliotis corrugata* (16,22,24,27, and 31mm) were found in the 20 ARMs indicating some recruitment. One *H. rufescens* measuring 112mm was found in ARM# 2353. This may be the same *H. rufescens* that was found in 1996 in ARM# 2354 measuring 74mm, the ARMs are both in the eastern group. *Cypraea spadicea* were abundant with 9.5/ARM. The mean number of *Crassidoma (Hinnites) giganteum* was 1.1ARM, similar to past years. Small *Pisaster giganteus* were common with a mean of 1.9/ARM. The mean number of *Asterina (Patiria) miniata* was similar to previous years (3.5/ARM), but the mean size was higher at 34mm. *Strongylocentrotus franciscanus* density was similar to last year, with a mean of 31/ARM. *S. purpuratus* density was also similar to last year with a mean of 131/ARM. Within and between the groups of five ARMs, there was a large variability in the number of *Strongylocentrotus spp.* in each ARM. This scenario was similar to past years, and we feel that the seven ARMs sampled for *Strongylocentrotus spp.* provided a good representation of the *Strongylocentrotus spp.* population in the ARMs.

**Location: Yellowbanks (not kfm site), Santa Cruz Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 33 59.857      Loran #s: 28010.15

Longitude: 119 31.129      41421.85

1997 sampling dates: 8/4.

1997 status: *Pelagophycus porra* forest.

We conducted a survey dive at a depth of 30-36 meters in the same area we dove in 1995. Overall, this site appeared similar to two years ago. This area was a mature Elk kelp, *Pelagophycus porra* forest. Both large and small *P. porra* plants were present and a thick understory of brown algae that consisted mostly of *Laminaria farlowii*, *Agarum fimbriatum*, *Eisenia arborea*, *Pterygophora californica*, and *Cystoseira* sp.. Some foliose red algae were present, but were not nearly as abundant as the brown algae. No *Macrocystis pyrifera* was present. Approximately 50% of the bottom was hard substrate, while the other 50% was sand. Much of the sandy areas were only a thin layer of sand over hard substrate.

Several of the divers searched for abalone. Two live *Haliotis rufescens* were found measuring 187, and 206mm. *H. rufescens* shells were common, and several *H. corrugata* and two *H. sorenseni* shells (144 and 149mm) were found. Fish were not particularly abundant. *Chromis punctipinnis*, and *Oxyjulis californica* were common. Several female and one large male *Semicossyphus pulcher* were observed. One small lingcod, *Ophiodon elongatus*, was observed. Pelagic ctenophores were common over the site.

**Location: Cavern Point, Santa Cruz Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Approximate Latitude: 34 03.25, Longitude: 119 34.60

1997 sampling dates: 8/8.

1997 status: *Strongylocentrotus purpuratus* barrens/open area.

We conducted a brief survey dive at a depths between 2-20 meters. This area was similar to our Scorpion Anchorage site in that it was mostly *Strongylocentrotus purpuratus* barrens. However, on top of many rocks, there were few *S. purpuratus* and an abundance of encrusting invertebrates and some low growing algae. Most of these invertebrates consisted of the bryozoans, *Diaperoecia californica*, and *Bugula neritina*. Large and small *Crassedoma (Hinnites) giganteum* were abundant on large rocks. *Lithopoma (Astraea) undosum* were common, and *Aplysia californica* were moderately abundant and were often observed in groups of 10-20 mating. No live *Haliotis* spp. were found, but old *Haliotis corrugata* shells

were common in the deeper areas, and one old *H. rufescens* shell was found. *Lophogorgia chilensis* were abundant in the deeper areas (greater than 15 meters).

*Chromis punctipinnis*, *Oxyjulis californica*, *Girella nigricans*, *Paralabrax clathratus* and smelt (either *Atherinopsis californiensis* and/or *Atherinops affinis*) were abundant. It was common to see small groups of smelt hanging around a small *Oxyjulis californica* waiting to be cleaned. It was interesting to note that it was only the small *O. californica* that seemed to set up these cleaning stations, although large *O. californica* were present.

It appeared that the rocks that were not urchin barrens were not as smooth (were bumpier) than the rocks that were covered with urchins and were bare. It is possible that the bumps may act as a barrier against the urchins, making it more difficult to feed.

### **Location: Sailboat Reef, Santa Cruz Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 33:58.58 N      Longitude: 119:36.81 W

1997 sampling date: 9/11.

1997 status: Mostly barrens with a moderate density of *Strongylocentrotus purpuratus*.

We conducted a survey dive ranging from a depth of 10-23 meters. This area consisted of a series of stair like drop-offs and ridges of moderate relief (3-6 meters in some areas). Coarse sandy areas were present in between the ridges. The area was mostly barren with only a few *Macrocystis pyrifera* and *Eisenia arborea* plants on top of the ridges. Although most of the area was barren there were only a moderate number of *Strongylocentrotus purpuratus*, and *S. franciscanus* in the deeper areas. Much of the bottom was either bare or covered with filamentous red algae or filamentous brown diatoms. On top of the reef there were several thick patches of the Parchment tube worm, *Chaetopterus variopedatus*, and patches of the bryozoan, *Diaperoecia californica*. *Lophogorgia chilensis* were moderately abundant in the deeper areas, and *Muricea californica* were common in the shallow areas. Several small *Panulirus interruptus* were observed. *Crassidoma (Hinnites) giganteum* were rare in the deeper areas, but more common in the shallower areas. On the sand *Mesochaetopterus taylori* and *Phoronopsis sp.* were common.

Sea stars were rare. One *Pisaster giganteus* was observed with wasting disease. *Strongylocentrotus purpuratus*, *S. franciscanus*, and *Lytechinus anamesus* were all observed with wasting syndrome.

At the base of the ridges and in-between them were an abundance of old *Haliotis corrugata* shells. There were no live or fresh *H. corrugata* found, indicating that there hasn't been abalone here for a number of years. However, the number of abalone shells indicate that there once was a substantial population of *H. corrugata* in this area.

The most common fish in this area were *Chromis punctipinnis*, *Coryphopterus nicholsii*, *Embiotoca jacksoni*, *Oxyjulis californica*, *Medialuna californiensis*, *Hypsypops rubicundus*, *Paralabrax clathratus*, and *Girella nigricans*. Several male and female *Halichoeres semicinctus* were observed. Several juvenile and female, and one male *Semicossyphus pulcher* were observed. Several people conducted a Roving diver fish count, and Laura Gorodezky with the Channel Islands National Marine Sanctuary collected that data.

### **Location: Ribbon Reef, Santa Cruz Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 33:58.96 N    Longitude: 119:34.74 W

1997 sampling date: 9/11.

1997 status: Kelp forest and *Strongylocentrotus purpuratus* barrens.

We conducted a survey dive at a depth of 13-15 meters. We set anchor in a patch of *Macrocystis pyrifera* that was approximately 100 X 100 meters. Most of the *M. pyrifera* plants were subadults or small adults and just reached the surface forming a thin canopy. There was little understory algae except for patches of filamentous red algae. The bottom consisted of large boulders and reef that was broken up with many cracks and crevices creating great habitat for *Panulirus interruptus*. *P. interruptus* were abundant at this site, with hundreds of small (less than legal size) and a number of legal ones being observed. We also observed a large aggregation of hundreds of hermit crabs that were mostly occupying *Kelletia kelletii* shells.

In the area where *M. pyrifera* was present, *Strongylocentrotus franciscanus* were common and *S. purpuratus* were rare. Outside the area where *M. pyrifera* was present, there were an abundance of *S. purpuratus* and fewer *S. franciscanus*. At the edge of the *M. pyrifera* forest there was a small sea urchin front that consisted of *S. franciscanus* and *S. purpuratus*, with the former being more abundant. *Centrostephanus coronatus* were common.

The area that was barren consisted of large cobble bottom with patches of rocky outcrops and silty/fine sediment patches. This area was mostly bare rock with a moderate number of *Strongylocentrotus purpuratus*. A large aggregation of *Bulla gouldiana* were observed.

*Chromis punctipinnis*, *Medialuna californiensis*, and *Paralabrax clathratus* were the most abundant fish. Small adult *P. clathratus* were notably abundant in the kelp forest. Several female and one large male *Semicossyphus pulcher* were observed. Several people conducted a Roving diver fish count, and Laura Gorodezky with the Channel Islands National Marine Sanctuary collected that data.

**Location: Admiral's Reef, Anacapa Island**

1997 sampling dates: 6/19, 8/5.

1997 status: Sparse kelp forest/*Strongylocentrotus purpuratus* and *Ophiothrix spiculata* (brittle star) barrens.

This site has changed little over the past three years. The transect continues to be dominated by the brittle star, *Ophiothrix spiculata* and *Strongylocentrotus purpuratus* on the eastern 70 meters of the transect. The west 30 meters have remained kelp forest. Similar to last year, *Macrocystis pyrifera* canopy cover over the transect was estimated at 10% and was entirely over the western end of the transect. Densities of adult, subadult, and juvenile *Macrocystis pyrifera* along the transect were low, 0.025/m<sup>2</sup>, 0.025/m<sup>2</sup>, and 0.0/m<sup>2</sup> respectively. Although no juvenile *M. pyrifera* were counted during quadrats, juveniles were common on the west end of the transect on the top of rocks. In June, most of the *M. pyrifera* appeared healthy. Combined, *M. pyrifera*, *Eisenia arborea* and *Pterygophora californica* combined covered 2.6% of the bottom, the lowest coverage recorded for this category at this site. Adult and juvenile *E. arborea* were common on top of rocks along the western end of the transect, similar to last year. Their densities were 0.21/m<sup>2</sup> and 0.083/m<sup>2</sup> respectively. *Laminaria farlowii* plants continued to be rare along the transect, but were common in the deeper areas near the transect. No adults or juveniles were observed on quadrats. No *Agarum fimbriatum* plants were observed. In past years, the eastern half of the transect typically had an abundance of *L. farlowii* and *A. fimbriatum*. *Cystoseira* sp. was rare along the transect, and none was observed during RPCs. Miscellaneous brown algae coverage was low (2.8%) and consisted mostly of *Dictyota/Pachydictyon*. All algae combined, excluding coralline algae, covered 43% of the bottom. This is an increase from last year, and was mostly a result of an increase in miscellaneous red algae and miscellaneous plants. Miscellaneous red algae was responsible for 25% of the 43%, and consisted mostly of a filamentous alga. Miscellaneous plants were responsible for 12% of the 43%, and consisted of mostly filamentous diatoms. These filamentous algae were more abundant on the western 30m of the transect, similar to last year. Articulated coralline algae covered 5.7% of the bottom, and encrusting coralline covered 30%. Bare substrate was relatively high for this site (28%), similar to last year.

The kelp forest located just inshore of the transect on top of the reef, still had an abundance of *Macrocystis pyrifera* and a moderate understory. This area appeared similar to the western 30 meters of the transect, and has changed little since last year.

The most common miscellaneous invertebrates encountered on RPCs were *Ophiothrix spiculata*, *Spirobranchus spinosus*, hydroids, a small unidentified anemone (possibly *Cactosoma arenaria* or *Sagartia catalinensis*), and gorgonians (mostly *Eugorgia rubens*). Because *Ophiothrix spiculata* were so abundant covering much of the bottom in some areas, they were counted separately and then added to the miscellaneous invertebrate category on RPCs. Miscellaneous invertebrates covered 57% of the bottom, of this 34% were *O. spiculata* and 19% were other miscellaneous invertebrates. As usual, the purple gorgonian, *Eugorgia rubens*, was abundant along the transect. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all relatively common with densities of 0.099/m<sup>2</sup>, 0.0083/m<sup>2</sup> and 0.029/m<sup>2</sup> respectively. *Corynactis californica*, and *Astrangia lajollaensis* were common covering 2.8%, and 4.2% of the bottom respectively. Bryozoans combined covered 3.2% of the bottom.

Similar to last year, *Strongylocentrotus purpuratus* and the brittle star, *Ophiothrix spiculata*, dominated the eastern two thirds of the transect. *S. purpuratus* density remained relatively high at 20/m<sup>2</sup>, but has been declining since 1995. *Strongylocentrotus franciscanus* were abundant with a density of 7.6/m<sup>2</sup>, similar to previous years. *Lytechinus anamesus* were uncommon relative to the previous several years; their density was 0.018/m<sup>2</sup> on band transects. *S. franciscanus* and *S. purpuratus* were not observed in the large grazing fronts as they were in 1995. *Centrostephanus coronatus* were relatively common with a density of 0.21/m<sup>2</sup>. Sea urchin wasting syndrome was commonly observed in *S. purpuratus*, *S. franciscanus* and *L. anamesus*. As mentioned above, *O. spiculata* covered 34% of the bottom. This coverage of has remained about the same for the previous two years. *Pisaster giganteus* were common with a density of 0.030/m<sup>2</sup> on 5-meter quadrats, none were observed in the regular quadrats. *Asterina (Patiria) miniata* were common with a density of 0.833/m<sup>2</sup>, ending their gradual increase since 1993. *Parastichopus parvimensis* were abundant with a density of 1.7/m<sup>2</sup>.

*Lithopoma (Astraea) undosum* were rare along the transect, and none were observed in quadrats. *Crassedoma (Hinnites) giganteum* were common with a density of 0.083/m<sup>2</sup>, and most were on the steep inshore side of the transect.. *Megathura crenulata* were common with a density of 0.014/m<sup>2</sup>. *Aplysia californica* were less common than the previous two years with a density of 0.0069/m<sup>2</sup>. *Kelletia kelletii* were uncommon, one was found during band transects. No *Haliotis corrugata* were observed during band transects, this is the third subsequent year that none were found. Only two *H. corrugata* were found during size frequency measurements. On June 19<sup>th</sup> one fresh *H. corrugata* shell (134mm) was found along the transect. No *Panulirus interruptus* were found during band transects, but two were observed within the transect boundaries.



*Chromis punctipinnis* were common along the transect. *Oxyjulis californica* were common in small groups, usually less than 10. During the roving diver fish count conducted on June 19<sup>th</sup>, no one observed more than one hundred. Female *Semicossyphus pulcher* were common, one male and one juvenile were observed. *Medialuna californiensis* and *Girella nigricans* were common. Three giant black sea bass, *Stereolepis gigas*, were observed at the site, and one diver observed one during the roving diver fish count on June 19<sup>th</sup>. One California moray eel, *Gymnothorax mordax*, was observed during band transects. *Coryphopterus nicholsii* were common with a density of 1.5/m<sup>2</sup>. *Alloclinus holderi* were relatively abundant with a density of 0.54/m<sup>2</sup>, their highest recorded density for this site. No *Lythrypnus dalli* were observed on quadrats, but they were common during the roving diver fish count on June 19<sup>th</sup>. The Roving diver fish count was conducted by five divers observing a total of 27 species.

All seven ARMs were intact and monitored for all indicator species. One of the ARM cages was replaced due to excessive corrosion. ARM #2306 was missing its stainless steel tag and was replaced with a new number, however we neglected to record the number and will have to do so on our next visit.

*Cypraea spadicea* were relatively uncommon with a mean of 1/ARM. The mean number of *Crassedoma (Hinnites) giganteum* was 1.7/ARM. *Asterina (Patiria) miniata* were abundant and the mean number per ARM has increased over the past three years. The mean number this year was 15/ARM. No *Pisaster giganteus* were found in the ARMs. The number of *Strongylocentrotus franciscanus* continued to decline for the fourth year. The mean number this year was 13/ARM. Similarly, the number of *S. purpuratus* has also continued to decline, the mean number this year was 35/ARM.

### **Location: Cathedral Cove, Anacapa Island**

1997 sampling dates: 7/25, 8/20.

1997 status: Kelp forest.

Overall, this site appeared similar to previous years. *Macrocystis pyrifera* canopy over the transect was estimated at 50% and most of the plants appeared healthy. Adult, subadult, and juvenile *M. pyrifera* were all common with densities of 0.21/m<sup>2</sup>, 0.20/m<sup>2</sup>, and 0.38/m<sup>2</sup> respectively, and covered 13% of the bottom. Juvenile *Laminaria farlowii* were less abundant than last year, and adults were more abundant. Their densities were 0.79/m<sup>2</sup> and 0.33/m<sup>2</sup> respectively. *Pterygophora californica* were absent from the site. *Eisenia arborea* were uncommon and only one juvenile was observed on quadrats (0.042/m<sup>2</sup>). *Cystoseira Spp.* was relatively abundant covering 20% of the bottom, its highest coverage since 1992. No Miscellaneous brown algae was observed during RPCs this year, the lowest recorded coverage for this category. There was a small amount of *Dictyota/Pachydictyon* along the transect, this alga was abundant

last year. Miscellaneous red algae was rare and none was observed on RPCs this year, its lowest recorded coverage. Articulated and encrusting coralline algae covered 30% and 56% of the bottom respectively. Bare substrate covered 17% of the bottom, similar to previous years. The large cobble area inshore at about 30 meters along the transect had little *M. pyrifera* compared to previous years, but was similar to last year.

The most common miscellaneous invertebrates on RPCs were *Spirobranchus spinosus*. This category covered 15% of the bottom. Bryozoans combined they covered 6.8% of the bottom. Tunicates covered 1.2% of the bottom. Only one *Lophogorgia chilensis* was observed along the transect, but it was not present in the band transects.

*Strongylocentrotus franciscanus* and *S. purpuratus* densities were 4.5/m<sup>2</sup> and 3.4/m<sup>2</sup> respectively. No wasting syndrome was observed in sea urchins, but several dead urchins were observed with all of their spines detached. Upon turning over these urchins it appeared that they were predated upon, possibly by a *Semicossyphus pulcher*. Overall, *S. franciscanus* are relatively large at this site with a mean size of 72mm. There were notably less *Asterina (Patiria) miniata* than last year, they were uncommon with a density of 0.042/m<sup>2</sup>. Juvenile *P. miniata* were common under rocks and in the ARMs. *Pisaster giganteus* are uncommon. None were observed on quadrats and 5-meter quadrats, however 27 were found in the seven ARMs. *Parastichopus parvimensis* were common with a density of 1.0/m<sup>2</sup>.

*Panulirus interruptus* were common with a density of 0.018/m<sup>2</sup>. Large and small (juvenile) *Lithopoma (Astraea) undosum* were abundant with a density of 3.9/m<sup>2</sup>. *Crassedoma (Hinnites) giganteum* density was 0.14/m<sup>2</sup>, and were predominantly on the inshore side of the transect. *Aplysia californica* density was 0.0069/m<sup>2</sup>, and were similar in abundance as last year. No black sea hares, *Aplysia vaccaria*, were observed this year. Four *Haliotis corrugata* were observed on band transects this year (0.0054/m<sup>2</sup>), and a total of 12 were found at the site for size frequency measurements. Several small/medium (66 and 81mm) sized *H. corrugata* were found indicating some successful recruitment several years ago. We often see small black copepods living on top of encrusting coralline algae and these are often common. However, during our August 20<sup>th</sup> visit we noted that they were extremely abundant, more abundant than we have ever observed anywhere.

Fish were moderately abundant. *Girella nigricans*, *Paralabrax clathratus*, adult and juvenile *Oxyjulis californica*, adult and juvenile *Chromis punctipinnis*, adult and juvenile *Embiotoca jacksoni*, *Sebastes atrovirens*, *Hypsypops rubicundus*, male and female *Halichoeres semicinctus* and female *Semicossyphus pulcher* were all common along the transect. Several male *S. pulcher* were observed. One juvenile, and one tagged adult *H. rubicundus* were observed toward the 100 meter end of the transect. *Coryphopterus nicholsii* were relatively uncommon with a density of 0.083/m<sup>2</sup>. *Alloclinus holderi* were common with a

density of 0.79/m<sup>2</sup>, similar to last year. One California moray eel, *Gymnothorax mordax*, was observed. Several juvenile *Sebastes* sp. were observed in the kelp canopy. Adult and juvenile kelp surfperch, *Brachyistius frenatus*, were notably abundant among the kelp stipes and blades in the kelp canopy. The roving diver fish count was conducted on August 20<sup>th</sup> with nine divers observing 28 species of fish.

Five ARMs were sampled for all indicator species and two for all indicator species except sea urchins. Three ARMs were missing stainless number tags, and new stainless steel tags were deployed: old brass tag number 169 was replaced with 2430 (formally stainless steel tag 2344), and new tags 2428 and 2429 were either 2345 and 2347, not respectively. The ARMs were intact, but appeared to have moved around a little. ARM #2349 was upside down.

Three small (14, 20, and 76mm) *Haliotis corrugata* were found in the seven ARMs. This indicates that there was some successful spawning last year. The number of *Crassedoma (Hinnites) giganteum* in the ARM continued to decrease for the second year, and there were few juveniles. This year there were 2.4/ARM, the lowest number since 1993. *Cypraea spadicea* were abundant with a mean of 13/ARM. *Lithopoma (Astraea) undosum* were common with 3/ARM. *Asterina (Patiria) miniata* were relatively abundant in the ARMs at this site with 9.4/ARM, an increase from 1996. Most of the *P. miniata* were small with a mean size of 22mm. *Pisaster giganteus* were common with 3.9/ARM, and were also small with a mean size of 33mm. *Strongylocentrotus franciscanus* and *S. purpuratus* were relatively abundant in the ARMs, but the mean number per ARM decreased some since last year. Their means were 41/ARM and 127/ARM respectively. Pycnogonids were common in the ARMs. Three were collected, and two were identified as *Tanystylum californicum* and one as *Nymphosis spinosissima*.

### **Location: Landing Cove, Anacapa Island**

1997 sampling dates: 8/6, 8/21, 11/4.

1997 status: Open kelp forest.

As usual, this site appeared to have changed little. *Macrocystis pyrifera* canopy cover was estimated at 15% and was thin probably due to the boat traffic in the Cove. Although there appeared to be little change at this site, *M. pyrifera* densities were relatively low. Adult, subadult and juvenile *M. pyrifera* densities were 0.050/m<sup>2</sup>, 0.11/m<sup>2</sup>, and 0.58/m<sup>2</sup> respectively, and covered 5.7% of the bottom. Adult *M. pyrifera* was present along the entire transect, but was most abundant on the eastern end as usual for this site. Understory algae was abundant along the transect. *Eisenia arborea*, and *Gelidium purpurescens* were abundant on the top of the reef on the shallow/eastern end of the transect. Adult and juvenile *Eisenia arborea* densities were 0.96/m<sup>2</sup> and 0.13/m<sup>2</sup> respectively, and covered 17% of the bottom. *Gelidium* spp. (*G. purpurescens*) coverage was 18%. Adult and juvenile *Pterygophora californica* were present along the deeper parts of the

transect. Adult and juvenile densities were 0.083/m<sup>2</sup> and 0.042/m<sup>2</sup> respectively, and covered 1.2% of the bottom. Adult and juvenile *Laminaria farlowii* were abundant in the deeper parts of the transect with densities of 2.4/m<sup>2</sup> and 2.6/m<sup>2</sup> respectively, and covered 7.5% of the bottom. *Cystoseira Spp.* was common covering 3.7% of the bottom. Miscellaneous red and brown algae (mostly *Dictyota/Pachydictyon*) were common with coverage's of 15% and 7.2% respectively. Brown diatom tufts (recorded as miscellaneous plants) were common covering 4.3% of the bottom. Articulated and encrusting coralline algae covered 11% and 35% of the bottom. Bare substrate covered 26% of the bottom and was most common in the deeper parts of the transect.

During a brief visit to this site on November 4<sup>th</sup> it appeared that the amount of *M. pyrifera* in Landing Cove notably decreased since our last visit on August 21<sup>st</sup>. Overall, one could describe landing cove as having few adult and subadult *M. pyrifera* plants on this date.

The most common miscellaneous invertebrates on RPCs were hydroids and *Spirobranchus spinosus*. This category covered 12% of the bottom. Bryozoans were common growing epiphytically on the *Gelidium purpurescens* and the other red algae growing on top of the shallow/eastern end of the transect. Combined, bryozoans covered 11% of the bottom. Most of the bryozoans and hydroids were found on top of the reef at the shallow/eastern end of the transect. Tunicates, and *Corynactis californica* were common on the shallow/eastern part of the transect with overall coverage's of 2.5% and 1.2% respectively. Encrusting sponges were abundant on the shallow/eastern part of the transect, their overall coverage was 5.0%.

*Asterina (Patiria) miniata* were rare as usual for this site, none were observed in quadrats this year. However, similar to Cathedral Cove, *A. miniata* are moderately abundant in the ARMs, but most are small. *Pisaster giganteus* were also rare and were counted on both quadrats and 5-meter quadrats, their respective densities were 0.0/m<sup>2</sup> and 0.0050/m<sup>2</sup>. *Strongylocentrotus franciscanus* and *S. purpuratus* were common with densities of 2.7/m<sup>2</sup> and 2.5/m<sup>2</sup> respectively, similar to previous years. Overall, *S. franciscanus* are relatively large at this site with a mean size of 88mm. *Parastichopus parvimensis* were common with a density of 0.71/m<sup>2</sup>. No sea star wasting disease or sea urchin wasting syndrome were observed at this site.

*Lithopoma (Astraea) undosum* were common with a density of 2.0/m<sup>2</sup>. One *Lithopoma (Astraea) gibberosa* was observed, a unusual sighting this far south/east. *Crassedoma (Hinnites) giganteum* were abundant along the vertical walls as is usual for this site, their density was 0.36/m<sup>2</sup>. *Haliotis corrugata* were common with a density of 0.024/m<sup>2</sup>. A good search effort was made to locate *H. corrugata* for size frequency measurements within the transect area, 41 were found. On August 21<sup>st</sup>, four fresh *H. corrugata* shells were found along the transect, indicating recent mortality. The shell sizes were 67, 146, 156, and 189mm. During a brief visit to this site on November 4<sup>th</sup> we observed several fresh *H. corrugata* shells. One was

broken into several large pieces and may have been a result of predation by a bat ray, *Myliobatis californica*.

Fish were moderately abundant as is usual for this site. Adult *Chromis punctipinnis* and *Girella nigricans*, adult and juveniles of *Oxyjulis californica*, adult and juvenile *Embiotoca jacksoni*, adult and juvenile *Paralabrax clathratus*, and adult *Girella nigricans* were all common. Several of the *P. clathratus* were notably large. One large male and female *Semicossyphus pulcher* were observed. Juvenile *Sebastes* spp. and *Heterostichus rostratus* were common in kelp canopy. *Coryphopterus nicholsii* were common in the deeper areas of the transect with a density of 0.17/m<sup>2</sup>. *Alloclinus holderi* were common with a density of 0.58/m<sup>2</sup>, the highest recorded density for this site.

Roving diver fish counts were conducted on August 6<sup>th</sup> with seven divers observing 23 species and on August 21<sup>st</sup> with eight divers observing 21 species.

During a brief visit to this site on November 4<sup>th</sup>, we observed over 17 juvenile *Hypsypops rubicundus* on top of the reef at the eastern end of the transect. These *H. rubicundus* were all estimated to be less than 4cm in total length. Juvenile *H. rubicundus* were also common at other places within Landing Cove. Several juvenile *Semicossyphus pulcher* were observed around the transect. Large schools of juvenile *Chromis punctipinnis* of several size groups, (but all were YOY and less than 4cm) were abundant throughout Landing Cove. They were readily using the boat as a place to aggregate, possibly because of the lack of *M. pyrifera* cover. Note that these juvenile fish were rare to nonexistent during our previous visit on August 21<sup>st</sup>.

Four ARMs were monitored for all indicator species, and three were monitored for all indicator species except sea urchins. Only one *Haliotis corrugata* was found this year, measuring 74mm. *Crassedoma* (*Hinnites*) *giganteum* were common with a mean of 3.3/ARM. *Lithopoma* (*Astraea*) *undosum* were relatively common with 2.7/ARM. *Cypraea spadicea* were common with 5.9/ARM. Similar to past years *Asterina* (*Patiria*) *miniata* were common with a mean number of 8.7/ARM and were small with a mean size of 25mm. *Pisaster giganteus* were relatively uncommon in the ARMs for this site with a mean of 0.43/ARM. Both *Strongylocentrotus franciscanus* and *S. purpuratus* were much less abundant than last year and their mean size increased slightly. Their densities this year in the ARMs were 36/ARM and 126/ARM respectively.

Two ARMs were missing number tags and given new ones; 2407 replaced 2376 and 2416 replaced 2375. The number of *Strongylocentrotus* spp. in the ARMs varied greatly from ARM to ARM. It appears that the difference was because of the five ARMs sampled for sea urchins, two were ARMs that were deployed last year. There appears to be a considerable time lag for the ARMs to be completely colonized.

**Location: West end of East Fish Camp, Anacapa Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 34 00.327 N, Longitude: 119 23.180 W

1997 sampling dates: 8/21.

1997 status: *Strongylocentrotus purpuratus* barrens.

We conducted a brief survey dive here. Overall, this area was barren and has been barren for a long time according to Captain Diane Richardson. There were patches of rocky reef with several meters of relief and patches of coarse sand. Most of the area was devoid of algae and had high densities of *Strongylocentrotus purpuratus*. There were several patches of *Ophiothrix spiculata* barrens towards the east. Inshore, *Eisenia arborea* was moderately abundant on top of rocks at a depth of less than 4 meters, and there was an occasional *Macrocystis pyrifera* plant. On top of large rocks, filamentous red algae was common. *Pisaster giganteus* and *Asterina (Patiria) miniata* were rare. Two *Henricia* sp. were observed and one had wasting disease. *S. purpuratus* and *S. franciscanus* were observed with wasting syndrome. *Chaetopterus variopedatus* were abundant in some areas. Small *Aplysia californica* were moderately abundant, and several large groups of recently dead individuals were observed. It is possible that these were killed by the recent large south swell that probably affected this area. *Crassedoma (Hinnites) giganteum* were moderately abundant, but most were small. Overall, fish were relatively uncommon.

**Location: Cat Rock, Anacapa Island**

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 33:59.86 N, Longitude: 119:25.23 W

Loran C #'s 28026.6, 41397.1

1997 sampling dates: 9/12.

1997 status: *Strongylocentrotus purpuratus* barrens and patches of understory kelp with little *Macrocystis pyrifera*.

We conducted several dives here with the purpose of conducting a abalone census. We received a report that this area used to be a favorite of local abalone fisherman up until the closure of the fishery. Historically, this has been one of the best spot on Anacapa Island for *Haliotis corrugata*.

This area consisted of *Strongylocentrotus purpuratus* barrens, and patches of understory kelps that consisted of mostly *Cystoseira* sp., *Laminaria farlowii*, Articulated coralline algae, and *Phyllospadix* sp.. There were several small patches of *Macrocystis pyrifera*. There were also several patches of barrens

that had high densities of *S. franciscanus*. It was reported that several years ago much of this entire area was a lush *Macrocystis pyrifera* forest.

Divers searched for abalone armed with calipers and chalk to mark abalone that were measured so another diver would not measure the same abalone. A total of 71 *Haliotis corrugata* were measured, ranging in size from 39mm to 167mm. Old *H. corrugata* shells were common, but were not counted or collected. We did collect and measured all of the fresh *H. corrugata* shells that were found. A total of 10 fresh shells were found, indicating recent mortality. All of the live *H. corrugata* found appeared healthy and most were hungry, readily accepting *Macrocystis pyrifera* blades.

Approximately half of the *H. corrugata* were found solitary, where as the other half were directly adjacent to other *H. corrugata*. Several small *H. corrugata* were observed, indicating some recruitment. Relative to other areas outside the Anacapa Island ecological preserve, this area had a moderate number of *H. corrugata*. Please note this is a relative abundance, as most of Anacapa is almost completely devoid of *H. corrugata*. Most areas on Santa Barbara, Anacapa, and Santa Cruz Islands where historically there were reports of large numbers of *H. corrugata* are now mostly devoid of this species or have very low densities.

#### **Location: Southeast Sea Lion, Santa Barbara Island**

1997 sampling dates: 6/16, 6/17, 9/23.

1997 status: *Strongylocentrotus purpuratus* barrens.

Overall, the site has changed little since last year, and continues to be a barren dominated by *Strongylocentrotus purpuratus*. There was no notable change over the summer. Macroalgae continued to be virtually absent along the transect. No macroalgae was observed on quadrats. One subadult and one juvenile *Macrocystis pyrifera* were observed along the transect, both of these were growing epiphytically on *Muricea californica*. The subadult plant was on the same *M. californica* that had *M. pyrifera* growing on it last year. One *Gigartina corymbifera* plant was observed, also growing epiphytically on a gorgonian. Small clumps of *Pachydictyon/Dictyota* were common growing on small rocks in the sandy areas of the transect. *Codium setchellii* was common on top of rocks. Not including coralline algae, algae combined covered 19.6% of the bottom, an increase from last year. This algae consisted of 9.3% miscellaneous red algae that was a filamentous type, and 10.3% miscellaneous plants, that was a filamentous diatom. Encrusting coralline algae was abundant covering 40% of the bottom. Articulated coralline algae were relatively rare covering 0.5% of the bottom. Bare substrate covered 23% of the bottom.

The miscellaneous invertebrate category on RPCs covered 16% of the bottom, an increase from last year. Similar to last year the most common miscellaneous invertebrate was a small unidentified anemone

believed to be *Cactosoma arenaria* or *Sagartia catalinensis*. This anemone was most abundant on the northern end of the transect. *Balanophyllia elegans*, and *Astrangia lajollaensis* were common covering 2.2% and 2.3% of the bottom respectively. Tunicates were common with a coverage of 3.2%. Sponges and bryozoans were rare. *Tethya aurantia* were abundant with a density of 0.13/m<sup>2</sup>. Large *Lophogorgia chilensis* were common, while small (<15cm in height) were relatively abundant. Their density was 0.22/m<sup>2</sup>. *Muricea californica* were common, while *M. fruticosa* were less common. Their densities were 0.028/m<sup>2</sup> and 0.0028/m<sup>2</sup> respectively. The temperature logger housing was almost completely covered with *Spirobranchus spinosus* and a few barnacles.

*Strongylocentrotus purpuratus* were abundant and dominated the site. *S. purpuratus* density was 41/m<sup>2</sup>, a small decrease from last year. *S. franciscanus* were common with a density of 2.8/m<sup>2</sup>, similar to last year. Juvenile *S. franciscanus* and *S. purpuratus* continue to be uncommon. *Lytechinus anamesus* were common with a density of 2.5/m<sup>2</sup> on band transects. Only one diver counted *Lytechinus anamesus* during quadrats, (data was not entered in the data base because of this) and the number of *L. anamesus* per meter on this observers side of the line was 5.2/m<sup>2</sup>. In general, sea urchins were out in the open and not confined to crevices. Both small and large *Centrostephanus coronatus* were relatively common, but only one was observed on quadrats (0.042/m<sup>2</sup>). *Asterina (Patiria) miniata* and *Pisaster giganteus* were common with densities of 0.38/m<sup>2</sup> and 0.17/m<sup>2</sup> respectively on quadrats. *P. giganteus* were also counted on 5-meter quadrats with a density of 0.11/m<sup>2</sup>. *Parastichopus parvimensis* were common with a density of 0.63/m<sup>2</sup>. The brittle star, *Ophiothrix spiculata* were common, but patchy, and were mostly along the mid section of the transect. They do not appear to be increasing in abundance since last year. There were several high density patches of *O. spiculata* outside of the transect area.

Sea urchin wasting syndrome was less prevalent than last year, and was only observed in two *Strongylocentrotus franciscanus* on June 17<sup>th</sup>. Whole sea urchin tests were common for all species, but not notably abundant. No sea stars were observed with wasting disease until September 23<sup>rd</sup> when we observed several wasting *Asterina (Patiria) miniata*, however most appeared healthy. Two unhealthy (deteriorating epidermis) looking *Parastichopus parvimensis* were observed on June 17<sup>th</sup>.

*Lithopoma (Astraea) undosum* were common with a density of 0.21/m<sup>2</sup>. *Kelletia kelletii* are usually rare at this site. None were observed during band transects, and only one was observed along the transect. *Megathura crenulata* were rare along the transect, and only two were observed on band transects. No live *Haliotis* spp. were observed this year. Several large old *H. corrugata* shells were present along the transect, but not collected. Two small fresh *H. corrugata* shells (22, 23mm) and one small old shell (28mm) were collected. *Aplysia californica* were common, but not as abundant as last year with a density of 0.064/m<sup>2</sup>. The turban snails, *Tegula eiseni*, were common. On June 16<sup>th</sup>, mysids were abundant near the bottom.



Overall, there was a very low diversity and abundance of fish at this site during both of our visits. Most of the fish present (other than *Alloclinus holderi* and *Coryphopterus nicholsii*) were present on the southeast end of the transect. Three adult and one juvenile *Hypsypops rubicundus* were observed along the transect. Only one juvenile (counted as a female in the roving diver fish count) and one male *Halichoeres semicinctus* were observed. *Semicossyphus pulcher* were rare, and on the day of the roving diver fish count and fish transects only several small females were observed. The following day they were still relatively uncommon, but several more were observed including one small male. In the past this site has had an abundance of *S. pulcher*. All of the *S. pulcher* observed were notably small. *Chromis punctipinnis* were relatively uncommon. *Paralabrax clathratus* were also relatively uncommon, and all were notably small. A small school of about 10 *Girella nigricans* were present on the southeast end of the transect. *Oxylebius pictus* were rare, and only several were seen. One *Caulolatilus princeps* (ocean whitefish) and one *Gymnothorax mordax* (California moray eel) were observed. One *Lythrypnus dalli* was observed during quadrats ( $0.042/\text{m}^2$ ), but none were observed during the roving diver fish count. *Coryphopterus nicholsii* were common with a density of  $0.46/\text{m}^2$ . Similar to the other two sites at this Island, *Alloclinus holderi* were abundant with a density of  $1.6/\text{m}^2$ , by far the highest density recorded at this site. *A. holderi* were the most abundant fish this year at this site. We estimated that at least 50% of these were small/juveniles. Roving diver fish counts were conducted on June 16<sup>th</sup> with seven divers observing 14 species and on September 23<sup>rd</sup> with five divers observing 11 species. During both counts, diversity was low, and most species were observed with low abundance's.

The temperature logger was retrieved, but it stopped recording data on March 15, 1997. No backup logger was available, so there is no temperature data for this site from March 11<sup>th</sup> - June 17<sup>th</sup>.

### **Location: Arch Point, Santa Barbara Island**

1997 sampling dates: 6/17, 6/18, 9/23.

1997 status: *Strongylocentrotus purpuratus* barrens.

Similar to Southeast Sea Lion, this site has changed little and continues to be dominated by *Strongylocentrotus purpuratus*. There was no *Macrocystis pyrifera* along the transect, however several plants were present on rocks in the sand east of the transect, and off the transect on the southern and northern ends. No algae was observed on quadrats. One juvenile *Eisenia arborea* was growing on the top of the temperature logger housing. Similar to Southeast Sea Lion, the most significant change in algae coverage was an increase in miscellaneous plants with a coverage of 16%, and a small increase in miscellaneous red algae with a coverage of 9.5%. The miscellaneous plants consisted of filamentous diatoms and the miscellaneous red algae was mostly filamentous. *Hypsypops rubicundus* nests were

common. Some *Laurencia pacifica* and *Colpomenia* sp. was present on top of large rocks/boulders. Articulated coralline algae covered 6.0% of the bottom, an increase from last year. Encrusting coralline algae was abundant covering 56% of the bottom. Bare substrate covered 22% of the bottom.

The most common miscellaneous invertebrates on RPCs were hydroids and *Spirobranchus spinosus*. This category covered 5.5% of the bottom. *Corynactis californica* were common covering 3.7%. Tunicates were uncommon with a coverage of 0.17%. Coverage of bryozoans continued to be low, covering 0.67% of the bottom. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all present, but uncommon. Of these, only *L. chilensis* was observed during band transects ( $0.0042/\text{m}^2$ ). The temperature logger housing was almost completely covered with *Spirobranchus spinosus* and barnacles.

Only one *Asterina (Patiria) miniata* ( $0.042/\text{m}^2$ ), and three *Pisaster giganteus* ( $0.13/\text{m}^2$ ) were observed on quadrats. *Pisaster giganteus* were also counted on 5m quadrats with a density of  $0.085/\text{m}^2$ . A good search effort was made for size frequencies and only one *Asterina (Patiria) miniata*, and 19 *Pisaster giganteus* were found. *Parastichopus parvimensis* were relatively uncommon with a density of  $0.21/\text{m}^2$ . No sea star wasting disease was observed.

*Strongylocentrotus purpuratus* were abundant with a density of  $58/\text{m}^2$ . However, they have been declining since 1995 (*S. purpuratus* density in 1995 and 1996 was  $134/\text{m}^2$  and  $96/\text{m}^2$  respectively). *S. franciscanus* were common with a density of  $3.8/\text{m}^2$ , similar to last year. Juvenile *S. purpuratus* and *S. franciscanus* were rare. The mean size of *S. purpuratus* has gradually increased in size since 1995, this years mean size was 22mm. *Lytechinus anamesus* density was  $0.046/\text{m}^2$ . In general, sea urchins were out in the open and not confined to crevices. On June 17<sup>th</sup>, we observed only a few *S. purpuratus* with wasting syndrome. During our second visit on September 23<sup>rd</sup> we noted that almost all of the *S. purpuratus* were affected by this syndrome in some areas. Almost all of the *S. purpuratus* along the southern end of the transect were notably affected by wasting syndrome, and many were near death. The *S. purpuratus* along the northern half of the transect were healthier and only half were estimated to show signs of wasting syndrome. Although we did not conduct density counts on September 23<sup>rd</sup>, it appeared that *S. purpuratus* density declined since June 17<sup>th</sup>. Whole *S. purpuratus* tests were common indicating recent mortality. Several *S. franciscanus* were observed with wasting syndrome on September 23<sup>rd</sup>.

Similar to Southeast Sea Lion, *Aplysia californica* were less abundant than last year with a density of  $0.14/\text{m}^2$ , still relatively high. *Lithopoma (Astraea) undosum* were common but densities have greatly declined the last two years, this year the density was  $0.50/\text{m}^2$ . *Crassidoma (Hinnites) giganteum* were common with a density of  $0.011/\text{m}^2$ . The turban snails, *Tegula aureotincta*, and *T. eiseni* were moderately

abundant. Two divers searched for *Megathura crenulata* for size frequency measurements, but none were observed.

Adult *Hypsypops rubicundus* were abundant, and juveniles were common. *H. rubicundus* nests were common, and two tagged *H. rubicundus* were observed. *Chromis punctipinnis*, *Paralabrax clathratus*, *Medialuna californiensis*, *Girella nigricans*, female *Semicossyphus pulcher*, and *Oxyjulis californica* were all common. Male *S. pulcher* were less common and were small. One male and several female *Halichoeres semicinctus* were observed. One *Caulolatilus princeps* was observed. Similar to the other two sites at this island, *Alloclinus holderi* were abundant with a density of  $3.1/\text{m}^2$ . This was also the highest recorded density for this site, and many of the *A. holderi* were small/juveniles. *Coryphopterus nicholsii* were rare, and only one was observed on quadrats,  $0.42/\text{m}^2$ . A small school of yellowtail, *Seriola lalandi* were observed at the site on September 23<sup>rd</sup>. Roving diver fish counts were conducted on June 17<sup>th</sup> with seven divers observing 19 species and on September 23<sup>rd</sup> with five divers observing 18 species.

On September 22<sup>nd</sup>, we deployed four ARMs about 10 meters south of the south end of the transect. These are the first ARMs to be deployed at Santa Barbara Island.

The temperature logger stopped recording data on January 22, 1997 due to battery failure. No backup logger was available, so there is no temperature data for this site from January 22<sup>nd</sup> - June 17<sup>th</sup>.

### **Location: Cat Canyon, Santa Barbara Island**

1997 sampling dates: 6/18, 9/23.

1997 status: *Strongylocentrotus franciscanus* and *S. purpuratus* barrens with a small remnant kelp forest on the western end of the transect.

This site has changed drastically since last year. Except for a small kelp forest that remains on the western 10 meters of the transect, this site is dominated by *Strongylocentrotus franciscanus* and *S. purpuratus*. Last year, this site was dominated by *Macrocystis pyrifera*. This change was not a surprise, and was anticipated due the abundance of *S. purpuratus* and *S. franciscanus* that were in close proximity to the transect in 1996.

*M. pyrifera* canopy cover was estimated at 5%, and was entirely over the west end of the transect. Only one adult *M. pyrifera* was counted on quadrats ( $0.042/\text{m}^2$ ) and two on 5-meter quadrats ( $0.01/\text{m}^2$ ). No juveniles were observed on quadrats, but several were observed near the adult plants on the west end of the transect. *M. pyrifera* coverage on RPCs was recorded at 2.7%. No *Eisenia arborea* or *Pterygophora californica* were present along the transect, however one adult *E. arborea* was observed just inshore of

the transect. No *Cystoseira* sp. was observed during RPCs, however there were several plants present on the western end of the transect. The most abundant algae, excluding coralline algae, were miscellaneous red algae and miscellaneous plants. These categories covered 11% and 16% of the bottom respectively. Miscellaneous red algae consisted mostly of filamentous red algae, and miscellaneous plants consisted mostly of filamentous diatoms. Articulated coralline algae decreased to 5.5%, its lowest recorded coverage for this site. Encrusting coralline algae increased to 49%, its highest recorded coverage for this site. Bare substrate increased in coverage to 30% (coverage in 1996 was 13%).

The area to the west and north (inshore) of the transect remained a "healthy" kelp forest throughout the summer (that is there was no notable change between our two visits). These areas still have an abundance of adult, subadult and juvenile *M. pyrifera*, and a moderate understory with few *Strongylocentrotus* spp. Fish were more abundant in the areas that had *M. pyrifera*.

Overall, invertebrates were notably less abundant than last year. Miscellaneous invertebrate coverage on RPCs declined to 4.5% of the bottom, and consisted mostly of the worm, *Spirobranchus spinosus*. *S. spinosus* was notably less abundant than in previous years. *Phragmatopoma californica* abundance has gradually declined the past two years. This year, none were observed during RPCs, and they were rare elsewhere along the transect. Bryozoans were rare and declined in abundance. Bryozoans combined covered 4.2% of the bottom. Tunicate coverage declined greatly to 1.3%. Coverage of tunicates has been notably variable at this site during the past four years. Gorgonians are rare at this site, and only one *Muricea californica* was observed on band transects. *Tethya aurantia* were rare, with only one observed during band transects.

*Asterina (Patiria) miniata* were rare. None were found during the quadrats, and only several were observed along the transect. *Pisaster giganteus* were common with a density of 0.083/m<sup>2</sup> on quadrats, and 0.085/m<sup>2</sup> on 5m quadrats. No sea star wasting disease was observed at this site this summer. *Parastichopus parvimensis* were common with a density of 0.34/m<sup>2</sup>.

Most of the area along the transect was sea urchin barrens. *Strongylocentrotus franciscanus* density was 13/m<sup>2</sup>, a small increase from last year, and the highest recorded density at this site. *S. franciscanus* appeared to be more widespread over the site than last year. *S. purpuratus* density increased to 31/m<sup>2</sup>, the highest density since 1992. Both *S. purpuratus* and *S. franciscanus* appeared to be larger than last year, and were out in the open, not confined to crevices. Juvenile *S. purpuratus* and *S. franciscanus* were rare. The mean size of *S. franciscanus* and *S. purpuratus* were much larger at this site compared to the other two sites at this Island. The mean size of *S. franciscanus* was 65mm compared to 42mm and 39mm at Southeast Sea Lion and Arch Point respectively. The mean size of *S. purpuratus* was 43mm

compared to 18mm and 22mm at Southeast Sea Lion and Arch Point respectively. *Centrostephanus coronatus* were rare at this site, and none were observed on quadrats.

On June 18<sup>th</sup>, no sea urchin wasting syndrome was observed. All of the sea urchins appeared healthy, and were difficult to remove from the rocks, even in the barren areas. During our second visit on September 23<sup>rd</sup>, we observed that most the *S. purpuratus* in barren areas showed signs of wasting syndrome, where as the *S. purpuratus* on the west end of the transect where a kelp forest remains, showed no signs of this syndrome. It appeared that some of the *S. purpuratus* were near death. *S. franciscanus* were abundant, but only a few were observed with wasting syndrome.

Similar to the other two sites on this Island, *Lithopoma (Astraea) undosum* density continued to decline, and none were observed on quadrats this year. The turban snails, *Tegula eiseni*, were abundant, and *T. aureotincta* were common. *Crassedoma (Hinnites) giganteum* were rare along the transect, and only one was found during band transects. *Kelletia kelletii* were rare, only one was observed along the transect and none were found during band transects. *Megathura crenulata* were common with a density of 0.036/m<sup>2</sup>. Their density has gradually increased over the last three years, and the density this year was the highest recorded for this site. *Aplysia californica* density was 0.015/m<sup>2</sup>. Several *Panulirus interruptus* were observed along the transect, mostly in the middle section. Their density was 0.0056/m<sup>2</sup>. Nudibranchs were rare along the transect, and only several *Flabellinopsis iodinea* were observed. Kelp snails, *Norrisia norrisi*, were rare and empty shells were numerous along the transect. These snails were abundant last year.

One adult *Haliotis corrugata* was observed on band transects (0/0014/m<sup>2</sup>). A good search effort was conducted for *Haliotis* spp. size frequency measurements and we searched the entire transect. A total of five *H. corrugata* and one *H. fulgens* were found. An additional three (123, 152, and 154mm) *H. corrugata*, and one (150mm) *H. fulgens* were found just outside of the transect area (these were not included in the database, as they were more than 10m away from the transect). On September 23<sup>rd</sup>, one fresh *Haliotis corrugata* shell was observed measuring 148mm.

Fish were relatively abundant at this site compared to the other sites at this Island. However, fish appeared less abundant than last year. *Myliobatis californica* were common. Juvenile and adult *Oxyjulis californica*, male and female *Halichoeres semicinctus*, female *Semicossyphus pulcher*, *Embiotoca jacksoni*, and *Medialuna californiensis* were all common. Male *Semicossyphus pulcher* were rare, and only one juvenile was observed. Juvenile *Paralabrax clathratus* were abundant, but only several adults were observed. *Coryphopterus nicholsii* were rare and none were counted during quadrats. Similar to the other two sites at this Island, *Alloclinus holderi* were abundant with a density of 1.7/m<sup>2</sup>. This was the highest recorded density for this site, and many of the *A. holderi* were small/juveniles. Roving diver fish

count was conducted twice, on June 18 with seven divers observing 20 species, and on September 23<sup>rd</sup> with seven divers observing 18 species.

One commercial sea urchin boat was observed fishing north west of the transect, and then along the east side of Sutil Island.

The temperature logger was working fine when it was retrieved, and collected a full 12 months worth of data.

**Location: Near underwater arch off Webster Point, Santa Barbara Island**

Latitude: 33:28.54 N                      Longitude: 119:03.42

**Note:** This is a survey site and not one of the permanent kelp forest monitoring sites.

Sampling Date: 9/22.

Status: Mature *Eisenia arborea* forest, kelp forest.

We conducted a brief survey dive of this area from a depth of 2-38 meters. Overall, this area appeared healthy compared to the rest of Santa Barbara Island. However, similar to the rest of the Island it lacked commercial and sport fished species. From the surface down to 38 meters *Macrocystis pyrifera* was common, however there was only a thin canopy as most plants just reached the surface. Juvenile, subadult and adult *M. pyrifera* were all present. From a depth of 2 to about 16 meters, there was a thick sub-canopy of articulated coralline algae and *Eisenia arborea*. There was an abundance of juvenile, small and large adult *E. arborea* plants, and they were present in high densities over large areas. At about 35 meters, *Pelagophycus porra* was observed. The red algae, *Plocamium* sp. was relatively abundant along the steeper areas.

Along the northern side of this dive spot was a vertical wall that dropped about 25 meters. This wall had an abundance of encrusting invertebrates. Most notable was the abundance of the *Diaperoecia californica*, and *Stylaster (Allopora) californica*. Small *Panulirus interruptus* and molts were common.

*Strongylocentrotus franciscanus* were common, but mostly confined to crevices. *S. purpuratus* were less common and were large. *Centrostephanus coronatus* were relatively common. *Pisaster giganteus* were common, and only a few *Asterina (Patiria) miniata* were observed. All echinoderms were healthy with no signs of sea star wasting disease or sea urchin wasting syndrome.

Overall, this site appeared to be excellent *Haliotis corrugata* habitat above 30 meters. However we only observed three live *H. corrugata* (two approximately 140mm and the other 70mm), old shells were

common, but not particularly abundant. Below 30 meters there appeared to be excellent *H. sorenseni* habitat, and one large (>165mm) one was observed, but no shells were found.

Male and female *Semicossyphus pulcher* were common, but were unusually small, including the males. Tiny juvenile *Chromis punctipinnis* were abundant in large schools. Large juvenile *Sebastes serriceps* were abundant as several of the observers noted this on this dive. Kelp surfperch, *Brachyistius frenatus*, and halfmoons, *Medialuna californiensis*, were relatively abundant. A large school of jack mackerel, *Trachurus symmetricus*, was present. A small school of Sargo, *Anisotremus davidsonii*, were observed at about 38 meters, the lower end of their depth range. Horn sharks, *Heterodontus francisci*, were common in the areas above 20 meters.

## DISCUSSION

### General Biology:

In 1997, *Macrocystis pyrifera* (giant kelp) forests were present at six of the 16 Kelp Forest Monitoring sites. These sites included, Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, Yellowbanks at Santa Cruz Island, Cathedral Cove and Landing Cove at Anacapa Island. One site, Rodes Reef at Santa Rosa Island was an "open" area with a moderate amount of understory red algae and a few *M. pyrifera* plants. Nine sites were dominated by echinoderms. Gull Island South, Pelican Bay, and Scorpion Anchorage at Santa Cruz Island, Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus*. Hare Rock, San Miguel Island, was dominated by *Strongylocentrotus franciscanus*. Cat Canyon, Santa Barbara Island, was dominated by both *S. purpuratus* and *S. franciscanus*. Admiral's Reef, Anacapa Island, was dominated by both *S. purpuratus* and the brittle star, *Ophiothrix spiculata*, however some *M. pyrifera* was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*, and had a moderate density of *S. purpuratus*, *O. spiculata*, and *Astrangia lajollaensis*.

Eight sites had high *Strongylocentrotus purpuratus* densities this year compared to seven sites in 1996. Similar to last year, *S. purpuratus* dominated many areas on Santa Cruz, Anacapa, and Santa Barbara Islands that would probably be kelp forests if *S. purpuratus* densities were lower. Much of the subtidal habitat at Santa Barbara Island continues to be sea urchin barrens with high densities of *S. purpuratus* and occasionally high densities of *S. franciscanus*. There were few canopy forming *Macrocystis pyrifera* plants at Santa Barbara Island. The only notable patches of *M. pyrifera* were remnant kelp forests around Sutil Island, Cat Canyon, the Webster point area, and some very small patches of kelp close to shore scattered around the island. At Anacapa Island, most of the south side and large patches of the north side of the middle and west parts of the island have high densities of *S. purpuratus* and little *M. pyrifera*. However, most of the area inside the Anacapa Ecological Refuge on the North side of East Anacapa had healthy *M. pyrifera* forests with low densities of *S. purpuratus*. Four of the five sites at Santa Cruz Island have high densities of *S. purpuratus*. Although sea urchin barrens exist on Santa Rosa and San Miguel Islands, they are less prevalent than at the southern/eastern Islands.

Although there seems to be an abundance of *S. purpuratus* at the Islands, it is worthwhile to note that with the exception of Cat Canyon at Santa Barbara Island where *S. purpuratus* densities increased, the density decreased or remained about the same at the other monitoring sites since 1996. The overall mean density of *S. purpuratus* of all 16 sites combined has decreased the last two years. The overall mean density in 1995, 1996, and 1997 were 29/m<sup>2</sup>, 22/m<sup>2</sup> and 19/m<sup>2</sup> respectively.



Sea urchin wasting syndrome (Richards and Kushner, 1992) was relatively rare in the early part of the summer, however, as the summer progressed both the proportion of sites where this syndrome was observed and the prevalence within the sites increased on Santa Cruz, Anacapa and Santa Barbara Islands (Table 6.). During our last cruise it appeared that wasting syndrome was causing mass mortality of *S. purpuratus* and to a lesser extent *S. franciscanus* at Arch Point and Cat Canyon, Santa Barbara Island. If this syndrome persists we predict that most of the sea urchins will die, as they did in this area in 1992. Overall, we observed wasting syndrome mainly affecting *S. purpuratus*, and *S. franciscanus*, but it was also observed in *Lytechinus anamesus*.

Sea star wasting disease (Schroeter and Dixon, 1988) was observed at 10 sites this year, compared to only two sites in 1996. This is the most number of sites this disease has been observed since we began tracking it in 1992. Four species of sea stars were observed with wasting disease this year (Table 6) compared to two in 1996. We observed the stars, *Dermasterias imbricata* and *Mediaster aequalis* for the first time with sea star wasting disease.

Sea star wasting disease followed a similar pattern as sea urchin wasting syndrome, where both the proportion of sites where this disease was observed and the prevalence within the site increased as the summer progressed. Although there may be many factors involved in the increase of both this disease and syndrome, we believe that the increasing water temperatures as the summer progressed are one of the main causes. However, if this were the sole cause of the increase we would have expected to observe more diseased sea stars on the warmer Islands (Santa Barbara and Anacapa) than we did. It appears that the sea stars at the warmer Islands may be more resilient to this disease.

It appears that the onset of sea star wasting disease, or at least the visual (deteriorating epidermis) onset of the disease can be very rapid. During our first visit to Gull Island South, Santa Cruz Island, on July 21<sup>st</sup> and 22<sup>nd</sup> we did not observe any signs of this disease. Four weeks later during our second visit on August 18<sup>th</sup>, we observed a high proportion of the *Asterina (Patiria) miniata* with wasting disease. Some of these stars were almost completely disintegrated. *Pisaster giganteus* were also observed with this disease, but a lower proportion appeared to be affected during this second visit.

*Alloclinus holderi* were recorded at some of their highest densities since they were added to the quadrat protocol in 1985. In general, *A. holderi* is a more southern species and the Channel Islands are the limit of its biogeographical range. *A. holderi* are common at the three eastern/southern most islands (Santa Barbara, Anacapa, and Santa Cruz) and are rare at the two western/northern most islands (Santa Rosa and San Miguel). Likewise, there is also a notable increase in their densities as one moves from east to west, Santa Barbara having the highest densities and San Miguel having the lowest. This year, densities at the five sites on Santa Rosa and San Miguel Islands were all 0.0/m<sup>2</sup>, which is not unusual. At the remaining 11 sites on Santa Barbara, Anacapa, and Santa Cruz Islands, nine experienced an increase in

density and two remained about the same. Of the nine sites that increased, eight had their highest recorded densities. The highest densities were recorded from Santa Barbara Island, and were over 3/m<sup>2</sup> at Arch Point. Most of the *A. holderi* observed were small and were probably young of year.

Similar to *Alloclinus holderi*, *Lythrypnus dalli* is a southern species with the Channel Islands also the limit of their biogeographical range. At the kelp forest monitoring sites, there was no notable increase in densities of this species from 1996.

On July 25<sup>th</sup>, we made a dive in the shallow sandy area of Cathedral Cove, Anacapa Island, to look for the *Triakis semifasciata*, Leopard Sharks, that are often present this time of year. We observed many adult sharks, and estimated that there were several hundred present.

During our last cruise at Santa Barbara Island we observed large schools of Sardines around the Island (mostly along the eastern side). We observed yellowtail, barracuda, and bonito feeding on these schools. Large groups of Pelicans, Western Gulls, and Cormorants were also observed feeding on the schools of sardines. About midway between Santa Barbara Island and Santa Rosa Island we observed a striped marlin repeatedly jump out of the water. Flying fish were commonly observed during the entire cruise, including at San Miguel Island. We observed one barracuda at Johnson's Lee, Santa Rosa Island. At Santa Barbara Island there was an abundance of pelagic organisms in the water column. Ctenophores, small jellyfish, copepods, and pteropods were all present in large numbers. In the morning we observed many of the ctenophores with euphausiids in their stomachs.

### **El Niño:**

Although water temperatures around the Channel Islands began to be anomalously warm, greater than +3 °F in May (NOAA, 1997). The effects of El Niño conditions on the kelp forest communities didn't become prevalent until the middle of August. By mid August we had completed most of the quadrat, band transect and random point contact counts which are the basis of our density estimates. Hence, this year's data will not represent the decrease in sea star populations we observed towards the end of summer, but we expect this information will show up in the 1998 data. The increase in Island Kelp fish, *Alloclinus holderi*, densities we mentioned above are most likely a result of the warm water brought by El Niño. Towards the end of summer we observed a higher than normal incidence of *Macrocystis pyrifera* frond and stipe degradation. This is likely due to the unusually high sea surface temperatures and may have future effects on *M. pyrifera* abundance.

In November, we had the opportunity to make a dive at Landing Cove, Anacapa Island. During this dive we observed relatively large numbers of juvenile *Hypsypops rubicundus* and several juvenile *Semicossyphus pulcher*. The numbers we observed suggest a higher recruitment than is usually

observed. During a El Niño event such as the one experienced, we would expect to see increased recruitment of warm water species. Although we only made this one observation towards the end of 1997, we have heard other reports of juveniles of these species being more common at other sites and Islands as well.

### **Protocol Changes:**

No protocol changes were conducted this year. Several of the kelp forest staff discussed and agreed that it would be a good idea to create a separate category for filamentous algae on random point contacts. All of the filamentous algae fill a similar functional group, and when they are grouped with the other green, red or brown miscellaneous algae it is hard to imagine what the data represents. That is, the appearance and ecology of a site is very different if it is covered with filamentous algae as opposed to miscellaneous foliose algae. Initiating this change may alleviate the problem people have identifying filamentous diatoms and filamentous brown algae, in that these could be lumped together.

### **Sampling difficulties:**

All proposed data collection was completed this year except for three fish transects and some temperature data. Fish transects were only conducted once at Hare Rock, Johnson's Lee North, and Yellow Banks due to unsafe diving/weather conditions or inadequate water visibility, and temperature data loss was due to remote temperature logger failures.

### **Artificial Recruitment Modules (ARMs):**

All of the Artificial Recruitment Modules present at ten sites were monitored this year. At Arch Point, Santa Barbara Island we deployed four ARMs near the transect. These are the first ARMs to be deployed at Santa Barbara Island.

Overall, there was no major recruitment event of any of the species we monitor in the ARMs. The most notable pattern of change in the ARMs are the decrease in the number of *Strongylocentrotus purpuratus* and *S. franciscanus* per ARM. The number of *S. purpuratus* decreased at seven sites and remained about the same at three sites. The number of *S. franciscanus* decreased at four sites, increased at one site and remained about the same at five sites. The one site where *S. franciscanus* increased (Johnson's Lee South), the increase was due to immigration and not recruitment as could be seen by the larger than juvenile sized animals. Small, less than 15mm *S. purpuratus* and *S. franciscanus* were rare in the ARMs this year, indicating little recruitment. The number of *Asterina (Patiria) miniata* per ARM increased at three sites, and decreased at one. This is a surprise because of the high incidence of sea star wasting disease we observed. However, this disease was most prevalent towards the end of summer, when many of the ARMs were already monitored.

### **Temperature:**

We have continued to experience problems with the STOWAWAY and HOBOTEMP temperature loggers failing to collect data. In most cases we believe the problem to be battery failure. As we recommended last year, all of the STOWAWAY loggers were deployed this summer to record only one temperature per hour. Previously, these units were programmed to take the average of 100 readings every hour. With this new setting we hope that the batteries will last longer, decreasing the chance of failure. The different setting should have little affect on this long-term data set.

It appears that the internal clock of the computer used to set the temperature loggers in the summer of 1996 was set about 150 minutes ahead of the actual time. This means a temperature logger deployed at 0800 hours (real time) read that it was deployed at 1030, and every time recorded thereafter is 150 minutes ahead. In the future we will be more careful to make sure that the internal clock in the computer is set correctly. Overall, this should have little impact on the data, since we calculate the daily mean of the temperature data. However, if one is to compare the temperature data with information that is time dependent such as the tides, this time difference will need to be taken into account.

Overall, the water temperatures in March, April, and May of 1997 were warmer than the same months in 1996. As the summer progressed, we gradually noticed the water temperature rising, and by the end of summer water temperatures in excess of 20 °C at Santa Cruz, Anacapa, and Santa Barbara Islands were common. This temperature data will not be available until 1998.

### **Resource Use:**

Live fish trapping and fishing continues to be one of the main inshore commercial fishing activities at the Channel Islands. At Landing Cove, Santa Barbara Island we were able to observe a fish receiver of one of the trappers. The receiver contained an estimated 200+ fish and the bottom layer of fish consisted mostly of dead fish. Most abundant were *Semicossyphus pulcher*, and there were several giant kelpfish, *Heterostichus rostratus*, and cabezon, *Scorpaenichthys marmoratus*.

### **Data Requests:**

We continued to have numerous requests for Kelp Forest Monitoring data in 1997: All Kelp Forest Monitoring data was sent to Dr. Allen Stewart-Oaten at the University of California at Santa Barbara. All fish transect and/or roving diver fish count data was sent to Dr. Ralph Larson at San Francisco State University, Irene Beers at the University of California at Los Angeles, and to Antonio Beaumord/Laura Gorodezky at the University of California at Santa Barbara/Channel Islands National Marine Sanctuary. All sea urchin data was sent to Dr. Peter Kalvass with the California Department of Fish and Game. All available temperature data from the remote temperature loggers was sent to Ginny Eckert and Donna Shroeder at the University of California at Santa Barbara.

For additional copies of this report, other annual reports, or if you are interested in obtaining the raw data, please write to the address below:

Channel Islands National Park  
1901 Spinnaker Drive  
Ventura, CA 93001

## ACKNOWLEDGEMENTS

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**Table 1.** Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
<b>ALGAE</b>		
Miscellaneous Green Algae		R
Miscellaneous Red Algae		R
Articulated Coralline Algae		R
Encrusting Coralline Algae		R
Agar weed	<i>Gelidium spp.</i>	R
Sea tongue	<i>Gigartina spp.</i>	R
Miscellaneous Brown Algae		R
Acid weed	<i>Desmarestia spp.</i>	R
Oar weed	<i>Laminaria farlowii</i>	R,Q
Bladder chain kelp	<i>Cystoseira spp.</i>	R
Giant kelp	<i>Macrocystis pyrifera</i>	R,Q,M
California Sea Palm	<i>Pterygophora californica</i>	R,Q
Southern Sea Palm	<i>Eisenia arborea</i>	R,Q
Miscellaneous plants		R
<b>INVERTEBRATES</b>		
Miscellaneous Sponges		R
Orange puffball sponge	<i>Tethya aurantia</i>	B,S
Southern Staghorn Bryozoan	<i>Diaperoecia californica</i>	R
Miscellaneous Bryozoans		R
California hydrocoral	<i>Stylaster (Allopora) californica</i>	B,S
White-spotted rose anemone	<i>Tealia lufotensis</i>	B
Red gorgonian	<i>Lophogorgia chilensis</i>	B,S
Brown gorgonian	<i>Muricea fruticosa</i>	B,S
California golden gorgonian	<i>Muricea californica</i>	B,S
Strawberry anemone	<i>Corynactis californica</i>	R
Orange cup coral	<i>Balanophyllia elegans</i>	R
Cup coral	<i>Astrangia lajollaensis</i>	R
Hydroids		R
Ornate tube worm	<i>Diopatra ornata</i>	R
Colonial sand-tube worm	<i>Phragmatopoma californica</i>	R
Scaled-tube snail	<i>Serpulorbis squamigerus</i>	R
Chestnut cowrie	<i>Cypraea spadicea</i>	Q
Wavy turban snail	<i>Lithopoma (Astraea) undosum</i>	Q,S
Red turban snail	<i>Lithopoma (Astraea) gibberosum</i>	Q,S
Bat star	<i>Asterina (Patiria) miniata</i>	Q,S
Giant-spined sea star	<i>Pisaster giganteus</i>	Q,S,M
Sunflower star	<i>Pycnopodia helianthoides</i>	B,S
White sea urchin	<i>Lytechinus anamesus</i>	B,S
Red sea urchin	<i>Strongylocentrotus franciscanus</i>	Q,S
Purple sea urchin	<i>Strongylocentrotus purpuratus</i>	Q,S
Warty sea cucumber	<i>Parastichopus parvimensis</i>	Q
Aggregated red sea cucumber	<i>Pachythyone rubra</i>	R
Red abalone	<i>Haliotis rufescens</i>	B,S
Pink abalone	<i>Haliotis corrugata</i>	B,S
Green abalone	<i>Haliotis fulgens</i>	B,S

**Table 1. Continued.**

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
Kellet's whelk	<i>Kelletia kelletii</i>	B,S
Giant keyhole limpet	<i>Megathura crenulata</i>	B,S
California brown sea hare	<i>Aplysia californica</i>	B
Rock scallop	<i>Crassedoma (Hinnites) giganteum</i>	B,S
California spiny lobster	<i>Panulirus interruptus</i>	B
Tunicates		R
Stalked tunicate	<i>Styela montereyensis</i>	Q
Miscellaneous Invertebrates		R
<b>FISH</b>		
Bluebanded goby	<i>Lythrypnus dalli</i>	Q
Blackeye goby	<i>Coryphopterus nicholsii</i>	Q
Island kelpfish	<i>Alloclinus holderi</i>	Q
Blacksmith	<i>Chromis punctipinnis</i>	V
Señorita	<i>Oxyjulis californica</i>	V
Blue rockfish	<i>Sebastes mystinus</i>	V
Olive rockfish	<i>Sebastes serranoides</i>	V
Kelp rockfish	<i>Sebastes atrovirens</i>	V
Kelp bass	<i>Paralabrax clathratus</i>	V
California Sheephead	<i>Semicossyphus pulcher</i>	V
Black surfperch	<i>Embiotoca jacksoni</i>	V
Striped surfperch	<i>Embiotoca lateralis</i>	V
Pile perch	<i>Damalichthys vacca</i>	V
Garibaldi	<i>Hypsypops rubicundus</i>	V
Opaleye	<i>Girella nigricans</i>	V
Rock Wrasse	<i>Halichoeres semicinctus</i>	V
<b>SUBSTRATE</b>		
Bare substrate		R
Substrates: Rock		R
Cobble		R
Sand		R

B= Band Transect

Q= Quadrat

R= Random Point Contact

M= 5m<sup>2</sup>-Quadrat

S= Size frequency Measurement

V= Visual Transect

**CHANGES IN SCIENTIFIC NOMENCLATURE:**

<i>Patiria miniata</i>	=	<i>Asterina miniata</i>
<i>Astraea undosum</i>	=	<i>Lithopoma undosum</i>
<i>Astraea gibberosa</i>	=	<i>Lithopoma gibberosum</i>
<i>Hinnites giganteum</i>	=	<i>Crassedoma giganteum</i>
<i>Allopora californica</i>	=	<i>Stylaster californica</i>

**Table 2.** Station Information.

<b>ISLAND</b>	<b>LOCATION</b>	<b>ABBREVIATION</b>	<b>DEPTH METERS</b>	<b>YEAR ESTABLISHED</b>
San Miguel	Wyckoff Ledge	SMWL	13-15	1981
San Miguel	Hare Rock	SMHR	6-9	1981
Santa Rosa	Johnson's Lee North	SRJLNO	9-11	1981
Santa Rosa	Johnson's Lee South	SRJLSO	14-16	1981
Santa Rosa	Rodes Reef	SRRR	13-15	1983
Santa Cruz	Gull Island South	SCGI	14-16	1981
Santa Cruz	Fry's Harbor	SCFH	12-13	1981
Santa Cruz	Pelican Bay	SCPB	6-8	1981
Santa Cruz	Scorpion Anchorage	SCSA	5-6	1981
Santa Cruz	Yellowbanks	SCYB	14-15	1986
Anacapa	Admiral's Reef	ANAR	13-15	1981
Anacapa	Cathedral Cove	ANCC	6-11	1981
Anacapa	Landing Cove	ANLC	5-12	1981
Santa Barbara	Southeast Sea Lion Rookery	SBSESL	12-14	1981
Santa Barbara	Arch Point	SBAR	7-8	1981
Santa Barbara	Cat Canyon	SBCAT	7-9	1986

**Table 3.** Summary of sampling techniques used to monitor population dynamics of selected kelp forest taxa.

<b>TECHNIQUE</b>	<b>SAMPLE NUMBER OF SIZE REPLECATES</b>
Quadrat count	1 m X 1 m 24X / site
Band Transect count	3 m X 10 m 24X / site
5m <sup>2</sup> -Quadrat	1 m X 5m 40X/ site
Random Point Contact	40 points 15X / site (0.5 x 3 m)
Visual Fish transects	2 m(w) X 3 m(h) X 50 m(l) 8X / sites 5 minutes
Video transects	5 minutes / 100 m; 2X / site, and also a 360° pan at 0, 50 and 100m along transect.
Size frequency measurements	30 to 200 / species: 1X / site (see size frequency measurement dimensions below)
Species Checklist	30 - 90 minutes, 1X / site
Artificial Recruitment Modules	7 - 15 modules / site

**Size Frequency measurement dimensions:**

<b>Genus</b>	<b>Sample Size</b>	<b>Measurement</b>
<i>Macrocystis</i>	100	Stipe count (1 m above bottom), max. holdfast diameter, mm
<i>Tethya</i>	30	Max. diameter, mm
<i>Stylaster (Stylaster (Allopora))</i>	50	Max. height and width, mm
<i>Lophogorgia</i>	30	Max. height and width, mm
<i>Muricea</i>	30	Max. shell length, mm
<i>Megathura</i>	30	Max. shell length, mm
<i>Haliotis</i>	30	Max. shell diameter, mm
<i>Lithopoma (Astraea)</i>	30	Max. shell length, mm
<i>Kelletia</i>	30	Max. shell length, mm
<i>Crassedoma (Hinnites)</i>	200	Max. test diameter, mm
<i>Strongylocentrotus</i>	200	Max. test diameter, mm
<i>Lytechinus</i>	30	Length of the longest ray, mm
<i>Pycnopodia</i>	30	Length of the longest ray, mm
<i>Asterina (Patiria)</i>	30	Length of the longest ray, mm
<i>Pisaster</i>		

**Table 4.** 1997 Kelp forest monitoring site status.

<b>ISLAND/SITE</b>	<b>STATUS</b>
<b><u>San Miguel Island:</u></b>	
Wyckoff Ledge	Mature kelp forest with dense understory of red and brown algae.
Hare Rock	<i>Strongylocentrotus franciscanus</i> Barrens.
<b><u>Santa Rosa Island:</u></b>	
Johnson's Lee North	Mature Kelp forest.
Johnson's Lee South	Mature kelp forest.
Rodes Reef	Open area with a moderate amount of understory red algae, and scattered <i>Macrocystis pyrifera</i> plants.
<b><u>Santa Cruz Island:</u></b>	
Gull Island South	<i>Strongylocentrotus purpuratus</i> barrens.
Fry's Harbor	Open area with high densities of aggregating red sea cucumbers, <i>Pachythyone rubra</i> , <i>Ophiothrix spiculata</i> , <i>Astrangia lajollaensis</i> and <i>Strongylocentrotus purpuratus</i> .
Pelican Bay	<i>Strongylocentrotus purpuratus</i> barren.
Scorpion Anchorage	<i>Strongylocentrotus purpuratus</i> barrens.
Yellowbanks	Kelp forest with a abundance of understory brown algae.
<b><u>Anacapa Island:</u></b>	
Admiral's Reef	Sparse kelp forest/ <i>Strongylocentrotus purpuratus</i> and <i>Ophiothrix spiculata</i> (brittle star) barrens.
Cathedral Cove	Kelp forest.
Landing Cove	Open kelp forest.
<b><u>Santa Barbara Island:</u></b>	
Southeast Sea Lion Rookery	<i>Strongylocentrotus purpuratus</i> barrens.
Arch Point	<i>Strongylocentrotus purpuratus</i> barrens.
Cat Canyon	<i>Strongylocentrotus franciscanus</i> and <i>S. purpuratus</i> barrens with a small remnant kelp forest on the western end of the transect.

**Table 5.** 1997 Kelp Forest Monitoring Program participant and cruise list.

<b>PARTICIPANTS</b>	<b>AFFILIATION</b>	<b>CRUISES PARTICIPATED</b>
Alesadrini, Stian	UCSC	2
Algren, Molly	UAK	2
Altieri, Andrew	UCSC	1
Anderson, Tui	UCSC	3
Brooks, John	NPS-SCRU	1
Brown, Jeanne	UCSC	4
Canestro, Don	UCSC	7
Conti, John	CHIS-VIP	1,4
Davis, Gary	CHIS	1
Donahue, Megan	UCD	3
Fastenau, Henry	UCD	7
Gorodezky, Laura	NOAA	6
Gotshalk, Chris	UCSB	7
Haaker, Peter	CDFG	6
Johnson, Gabrielle	UCSB	5
Kennedy, Kathleen	MLML	6
Kido, Janine	CSF/USC	5
Knowlton, Jim	CHIS	2,3,4,5,6
Koehnke, Jill	CSF/USC	5
Kushner, David	CHIS	1,2,3,4,5,6,7,
Lerma, Derek	CHIS	1,2,3,4,5,6,7
Lohuis, Derek	CHIS	3
Meyer, Carolyn	CHIS-VIP	5
Mondragon, Jeff	CHIS	1,2,3,4,5,6,7
Morgan, Jennifer	CHIS	1,2,3,4,5,6,7
Orchard, Sonia	UCSC	1
Richards, Dan	CHIS	3
Richardson, Diane	CHIS	1,2,3,5,6,7
Senning, Mark	CHIS	4
Shaffer, Johnathon	HSU	5
Taniguchi, Ian	CDF&G	4
Trone, John	UCSC	4
Waara, Robert	VINP	4
Walder, Ronald	MLML	2
Zentgraf, Michelle	UCSC	2

<b>CRUISE NUMBER</b>	<b>CRUISE DATES</b>	<b>SITES VISITED</b>
Cruise #1	June 16-20, 1997	SBSESL, SBCAT, SBAP, ANAR
Cruise #2	July 7-11, 1997	SRJLSO, SRJLNO, SMWL, SMHR, SCFH
Cruise #3	July 21-25, 1997	SRRR, SCGI, SCPB, SCSA, ANCC
Cruise #4	August 4-8, 1997	ANAR, ANLC, SCYB, SCSA, SCFH
Cruise #5	August 18-22, 1997	SCYB, SCGI, SCSA, SRRR, ANCC, ANLC
Cruise #6	September 8-12, 1997	SCYB, SRJLNO, SRJLSO
Cruise #7	September 22-26, 1997	SBSESL, SBCAT, SBAP, SRJLNO, SMWL, SMHR

**Table 6.** 1997 Echinoderm wasting disease/syndrome observations.

ISLAND/SITE	Sea Star Wasting Syndrome		Sea Urchin Wasting Syndrome	
	SPECIES OBSERVED	DATE(s)	SPECIES OBSERVED	DATE(s)
<b><u>San Miguel Island</u></b>				
Wyckoff Ledge	8	9/24	none	
Hare Rock	1,4	9/24	none	
<b><u>Santa Rosa Island</u></b>				
Johnson's Lee North	none		none	
Johnson's Lee South	1,4,8	9/10	none	
Rodes Reef	1	7/23, 8/19	none	
<b><u>Santa Cruz Island</u></b>				
Gull Island South	1,4	8/18	2,3	7/21, 7/22, 8/18
Fry's Harbor	1,4	8/7	2,3	7/11, 8/7
Pelican Bay	1	7/24, 8/19	2,3,6	7/24, 8/19
" "	4	8/19		
Scorpion Anchorage	1	7/24, 8/22	2,6	7/24, 8/22
" "	4	7/24		
Yellowbanks	1,8,9	9/8, 9/9	none	none
<b><u>Anacapa Island</u></b>				
Admiral's Reef	none		2,3,6	6/19, 8/5
Cathedral Cove	none		none	
Landing Cove	none		none	
<b><u>Santa Barbara Island</u></b>				
SE Sea Lion Rookery	1	9/13	6	6/17
Arch Point	none		2	6/17, 9/23
" "			6	9/23
Cat Canyon	none		2,6	9/23

**SPECIES LEGEND:**

- 1 = *Asterina (Asterina (Patiria)) miniata*
- 2 = *Strongylocentrotus purpuratus*
- 3 = *Lytechinus anamesus*
- 4 = *Pisaster giganteus*
- 5 = *Astrometis sertulifera*
- 6 = *Strongylocentrotus franciscanus*
- 7 = *Parastichopus parvimensis*
- 8 = *Dermasterias imbricata*
- 9 = *Mediaster aequalis*

none = not observed at this site during our visits in 1997

date = date(s) disease/syndrome was observed